

# LAB 4000

## SERVICE MANUAL

1999 EMC

<u>PAGE</u>	<u>CONTENTS</u>	<u>DRAWING SCHEMATIC</u>	<u>LAYOUT</u>
1-5	THEORY IN FUNCTION	4KFUN	
6	INTERNAL CONNECTIONS	4KCON	
7-9	INPUT AMPLIFIER	4KINP	4KINP-P
10-12	LF-AMPLIFIER	4KLF	4KLF-P
13-15	HF-AMPLIFIER	4KHF	4KHF-P
16-18	LED DISPLAY	2KLED	LED-P
19-21	FUSE BOARD VOLTAGE STAB	4KFU	4KFU-P
22.1-25.1.2	POWER SUPPLY <small>FROM SERIAL NO: 990-101</small>	PSU-G PSU-H	PSU-G-P PSU-H-P

<u>PAGE</u>	<u>CONTENTS</u>	<u>DRAWING SCHEMATIC</u>	<u>LAYOUT</u>
22-25	POWER SUPPLY <small>FROM SERIAL NO. 960-901 TO 981-225</small>	4KPSU-E 4KPSU-F	4KPSU-E-P 4KPSU-F-P

## SERVICEINFORMATION FOR LAB 4000

Serial number from: 990-226

### Low pass filter on input board.

LAB 4000 has a 24dB low pass filter on the input board.  
The filter has been modified for a higher corner frequency.

### Input board 2kinp

<u>Component</u>	<u>Old value</u>	<u>New value</u>
C6, C106	470pF	220pF
C7, C107	470pF	220pF
C8, C108	680pF	330pF
C9, C109	220pF	100pF

## SERVICEINFORMATION FOR LAB 1200,1300,1600,2000,4000

### New power supply board. PSUG, PSUH

#### Serial number from:

LAB 1200:	980-901
LAB 1300:	980-801
LAB 1600:	980-901
LAB 2000:	980-801
LAB 4000:	990-101

To be able to produce all the power supply on the same print board there have been some small changes done.

The out put power, and the electrical specification is not effected.

The new boards are called PSUG, and PSUH.

## SERVICEINFORMATION FOR LAB 4000

Serial number before 970-8xx

When the fans are changed, the fan control circuit should be modified.

### Power supply board PSU C

Q4    Change from   BDX 53F too        IRF 730

D7    New                15v 0,4w zener between Q4 g-s

D8    New                39v 0,4w zener between centre point of fans, and Q4 g

(D7 and D8 have too be installed on the solder side off PSU C ).

1996-12-06

## SERVICEINFORMATION FOR LAB 4000

**LF BOARD** serial number before 961-201

R24, R47 change from *10kohm* to **56kohm 1%**

**HF BOARD** serial number before 970-101

D1, D5 change from *1 diode* to **2 diodes BYW81pi200** in series

R63, R64 change from *3,9ohm* to **2,2ohm 2w**

C53, C54 change from *1nF* to **470pF 200V np0**

# LAB 4000

## Theory of function

### Powersupply

AC-power is coming in to terminal K1. The voltage is rectified by D1 and filtered by C10, C11. This gives 310V DC to the transformer TR1. The PWM-controller U1 controls the switch Q1-Q3 to give the correct output voltage at terminal J17, J19. When the switch Q1-Q3 is closed, current flows through transformer, TR1, storing energy. Because of the voltage polarity, diode D3, D4 are reverse-biased, thus no voltage present at the load. When the switch is open, transformer TR1 reverses polarity because of the collapsing magnetic field, forward-biasing diode D3, D4, and inducing a current flow into the capacitors C12, C14. The reversed voltage is sensed by a winding in TR1 and rectified by diode D8. The PWM-controller adjusts the on-time of the switch, by comparing the voltage across C14 with an internal reference, to give a rail voltage of  $\pm 155V$  across the capacitors C12, C14. The voltage can be adjusted by potentiometer TP2. The maximum current in the transformer is sensed over the resistor R6-R8. The voltage across R6-R8 is compared with a reference voltage, set by TP3, which makes it possible to adjust the maximum output power from the powersupply. Normally TP3 is in maximum position, but if something has to be repaired in the amplifier, TP3 is used for "slowstarting" the amplifier.

### Amplifier

The input signal is connected to the balanced amplifier U1. The gain in this amplifier can be reduced by optoresistor LDR1 to prevent clipping in the output amplifier. From amplifier U1 signal is going to limiter U2, Q1, Q2 passing gain control P1. This limiter together with the phase linear lowpass filter U3, U4 limits the slew rate of the signal going to the output amplifier 4KLF, preventing intermodulation in this amplifier if signals of too high frequencies are presented on the input terminal.

The output amplifier 4KLF works as an ordinary power amplifier with the difference that the collector voltage to the output transistors is supplied from the switchmode amplifier 4KHF. The base voltage on the output transistors Q26-Q28, Q31-Q33 is sensed by voltage divider R36-R38 and is then sent to the adjustable limiter U3, U4 on the input board, before it reaches the input on the switchmode amplifier. Limit level is set by the minimum load select-switches (MLS-sv.) to give correct output power in different loads.

The amplifier U1 (U2) on the HF-board makes sure that the output signal on terminal J4 (J8) is a copy of the input signal on terminal J12, by giving correct control voltage to pulsewidth modulator U3. U3 compares this voltage with an 614Khz triangular wave giving a pulsewidth modulated output signal from Q1 (Q7) which is filtered by L1, C1 (L4, C10). The gain from the base of the output transistors in the LF-amplifier to the output of the HF-amplifier is equal to one. TP1 (TP2) is used to add a DC-offset on the input of U1 (U2) giving  $+7,5V$  (J4) -  $7,5V$  (J8) relative output of the LF-amplifier (J6), which is the same as collector-emitter voltage for the output transistors Q26-Q28, Q31-Q33.

# REPAIRING INSTRUCTIONS

## REQUIRED MEASUREMENT EQUIPMENT:

- Audiogenerator
- AC-voltmeter/THD-meter
- 2 digital voltmeters
- Two channel oscilloscope for audio
- Variac 0-280V, 6A
- 50Mhz oscilloscope, ex. Tek 2225
- with 100x probe ex. Tek P6009

## AMPLIFIER

1. Without changing any fuses check the powersupply +155V, -155V, +16V, -16V, +30V. If these aren't OK go to section for repairing power supply.
2. If all fuses are OK, follow the signal from input to output, and repair in normal way. The best way is to place the amplifier on the front handles, loosen the rear panel, and mount it back on distances (delivered with this manual) to make it possible to measure.
3. If there is a fault in the power amplifier stage do as follows:
  - 3:1 Turn TP1, TP2 on the HF-board, TP3 on the power supply board counter clockwise.
  - 3:2 Short-circuit R38 on LF-board.
  - 3:3 Disconnect cables from Q28, and Q32 collectors on the LF-board.
  - 3:4 Replace broken fuses. (only for the channel you repair)
  - 3:5 Connect DC-voltmeter (200V) to the positive (negative) rail voltage.
  - 3:6 Connect another DC-voltmeter (20V) to the cable disconnected from Q28 (Q32).
  - 3:7 Turn TP3 (PSU) slowly clockwise, TP1 and watch the voltmeters. Rail voltage should increase rapidly, "collector voltage" should read 0. After turning TP3 maximum 30°, railvoltage should be 155V.
    - a. If the railvoltage is zero or very low, check Q1, D1 (Q7, D5) (shorted) on the HF-board..  
If Q1 (Q7) is broken, also replace R3 (R16) and D2 (D6).
    - b. If OK (155V) turn TP1 (TP2) slowly maximum clockwise. Voltage measured on the disconnected collector cable should stop at about 7,5V.
    - c. If OK turn TP1 (TP2) and TP3 counter clockwise.

- 3:8 Repeat from 3:5 for the negative side.
- 3:9 Reconnect cable to Q28 collector.
- 3:10 Connect dummy load  $16\Omega$  to output, and connect an oscilloscope (10V/div) across the load.
- 3:11 Slowly turn TP3 (PSU) for 155V (-155V) railvoltage.
- 3:12 Slowly turn TP1 (TP2) clockwise and look at the oscilloscope. There should be no DC on the oscilloscope. If there is DC (<1V) repair the positive (negative) output section on the LF-board.
- 3:13 Turn back TP1 (TP2) and TP3, and disconnct Q28 collector.
- 3:14 Reconnect Q32 collector and repeat from 3:11 for the negative side.
- 3:15 Reconnect cables to Q28 and Q32 collector. Turn TP3 for 155V rail voltage. Turn TP1 clockwise, no DC on the oscilloscope. Then slowly turn TP2 clockwise. There can be some oscillation with TP2 in middle position, but it will stop at further turning.
- 3:16 Connect 1KHz sine wave to the input of the amplifier. Adjust gain until there is signal on the output. It should be a 7V PK sinewave with no distortion.
- 3:17 Disconnect short circuit from R38, and the amplifier will work.

### POWER SUPPLY

Required measurement equipmen	-Isolationtransformator for the mains, 1:1
-Audiogenerator	-Variac 0-280V, 6A
-DVM	(-Two chanel oscilloscope for audio)
-50 MHz oscilloscope, ex. Tek 2225	(-AC Voltmeter/ THD-meter)
with 100x probe ex. Tek P6009	

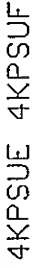
- 1) Turn TP2 and TP3 fully counter clockwise.
- 2) Change F1 on the PSUE.
- 3) Increase the main voltage slowly by the variac.
- 4) Measure the voltage across C1 on PSUF.
  - a) No voltage: -change R5.
  - b) The current inceases quickly: -check D1-PSUE.  
-check Q1, Q2, Q3.
- 5) It is now possible to increase the voltage across C1 on PSUF to approx. 300 V without current inrush.
- 6) Connect an oscillscope to mains voltage via an isolation transformer. Then measure across Q1 collector and emitter.

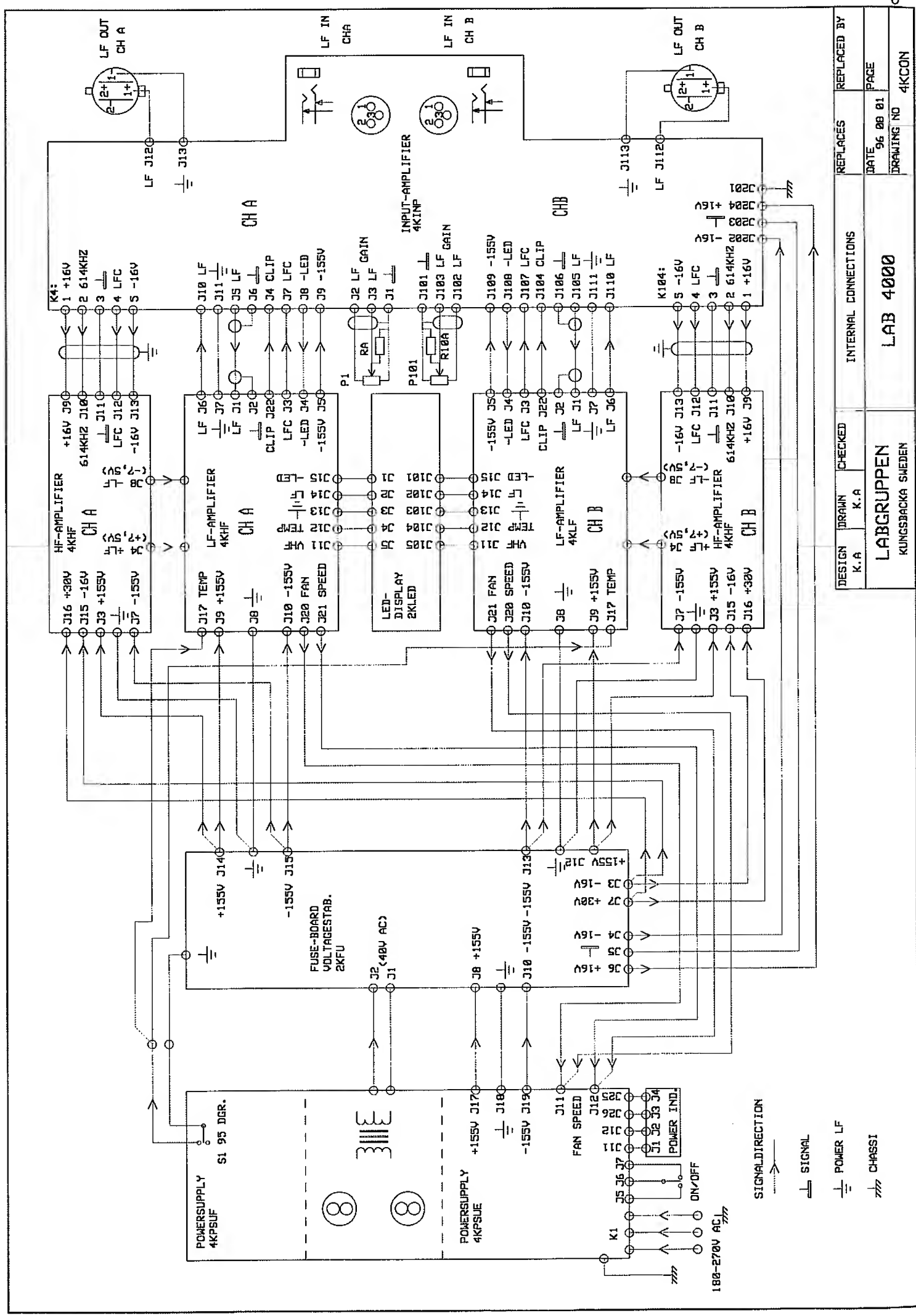


is approx. 27 kHz (see figure1). If the graph is seen, go to item 9).

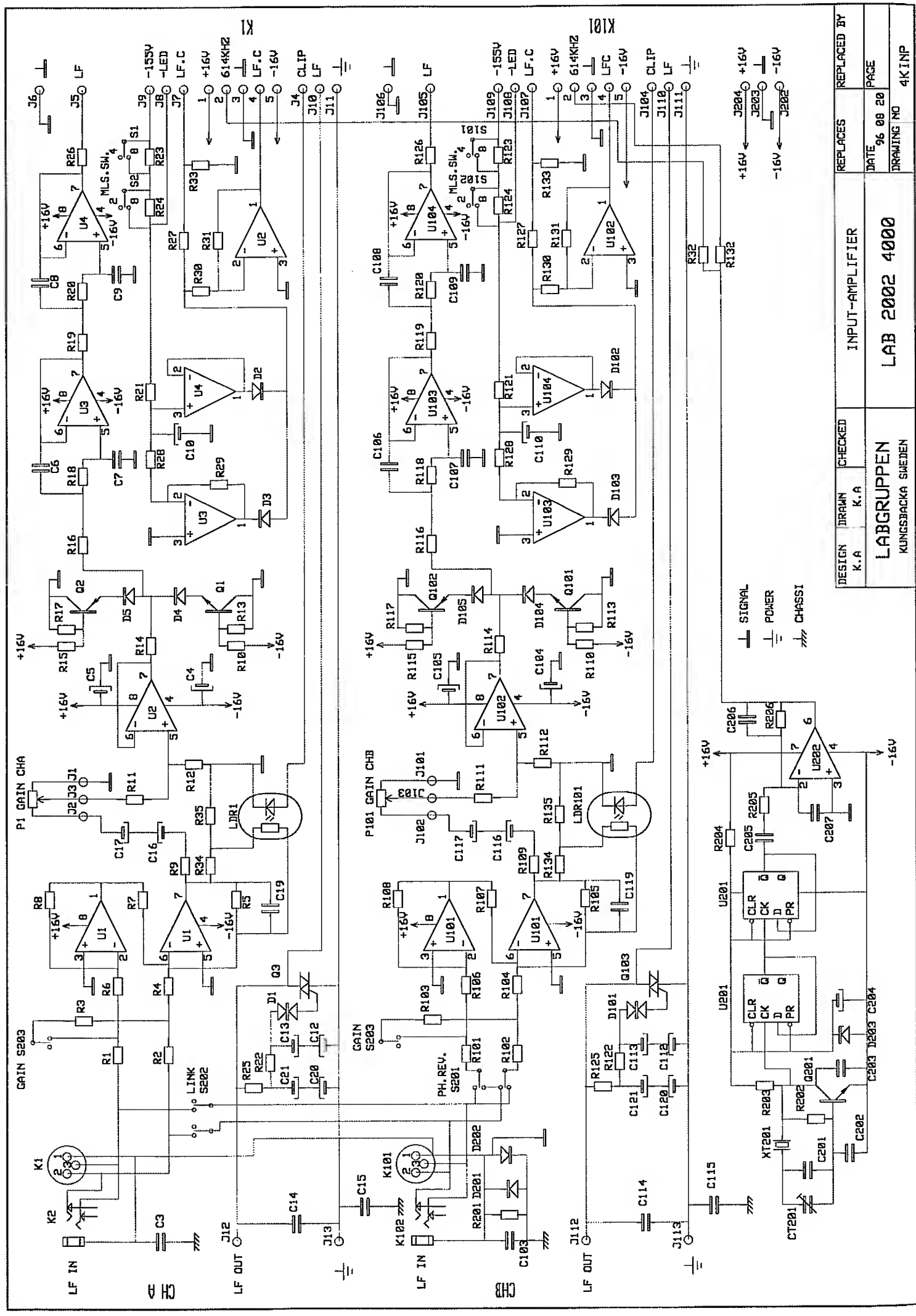
- 8) If only narrow spikes is seen, check the following components.
  - a) D3, D4 -PSUE or the output circuits.
  - b) D1 ( C5, R1) -makes U1 go into over voltage protection.
  - c) U1 -the output will remain low all the time.
- 9) Turn TP3 fully clockwise:
  - a) Check the output voltage on C12, C14 -PSUE for +- 155V.  
Adjust with TP2.
  - b) Check the softstart circuit by turn on and off the mains switch and look at the oscilloscope.
  - c) Increase the power by applying an audiosignal to the amplifier and turn up the gain controls. -The pulsewidth will increase.
  - d) Check the over/ under voltage protection circuits by turning the variac up to 280 VAC and down to 130 VAC. ( No load ).

Fig. 1

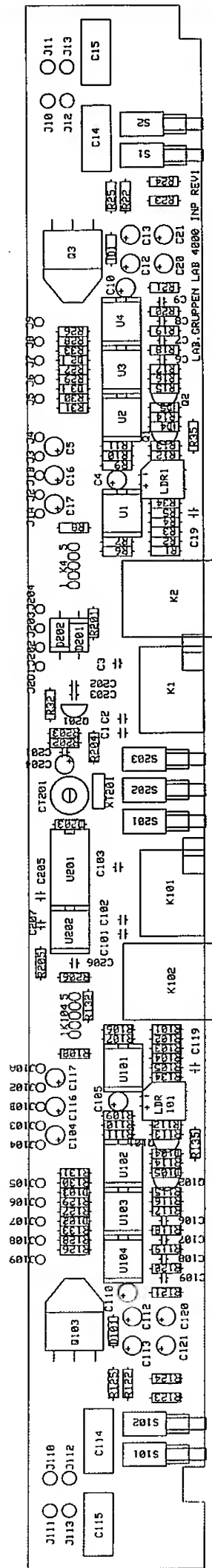
LAB 4000



DESIGN	DRAWN	CHECKED	INTERNAL CONNECTIONS	REPLACES	REPLACED BY
K.A.	K.A.				
LABGRUPPEN			LAB 4000	DATE	PAGE
KUNGSBACKA SWEDEN				96 08 01	4
				DRAWING NO	4KCON



DESIGN	DRAWN	CHECKED	INPUT-AMPLIFIER	REPLACES	REPLACED BY
K. A.	K. A.		LAB 2002 4000		
			KUNGSBACKA SWEDEN		
				DATE	PAGE
				96 08 20	
				DRAWING NO	4K INP



DESIGN	DRAWN	CHECKED	REPLACES	REPLACED BY
K.A	K.A			
LABGRUPPEN			INPUT AMPLIFIER	
KUNGSBACKA SWEDEN			LAB2002 LAB 4000	
			DATE	PAGE
			99 09 18	1
			DRAWING NO.	4KINPRI-P

# LAB 4000

## INPUT AMPLIFIER AND INTERNAL CONNECTIONS

### Component-list

#### LAB 4000 INPUT AMPLIFIER

Component-list Channel A (Ch. B; add 100, Ch. A+B add 200)

##### Resistors

R1	10 k $\Omega$ 1%	
R2	10 k $\Omega$ 1%	gain
R3	9,2 k $\Omega$ 1%	33 dB
	6,34 k $\Omega$ 1%	32 dB
	3,74 k $\Omega$ 1%	29 dB
	2,33 k $\Omega$ 1%	26 dB
	1,5 k $\Omega$ 1%	23 dB
R4	10 k $\Omega$ 1%	
R5	66 k $\Omega$ 1%	
R6	10 k $\Omega$ 1%	
R7	22 k $\Omega$ 1%	
R8	22 k $\Omega$ 1%	
R9	100 $\Omega$	
R10	47 k $\Omega$ 1%	
R11	1 k $\Omega$ 1%	
R12	47 k $\Omega$ 1%	
R13	18 k $\Omega$ 1%	
R14	1 k $\Omega$ 1%	
R15	47 k $\Omega$ 1%	
R16	10 k $\Omega$ 1%	
R17	18 k $\Omega$ 1%	
R18	10 k $\Omega$ 1%	
R19	10 k $\Omega$ 1%	
R20	10 k $\Omega$ 1%	
R21	715 k $\Omega$ 1%	
R22	27 k $\Omega$ 1% *	
R23	2,4 k $\Omega$ 1% long legs	
R24	4,7 k $\Omega$ 1W long legs	
R25	27 k $\Omega$ 1%	
R26	100 $\Omega$	
R27	10 k $\Omega$ 1% *	
R28	47 k $\Omega$ 1%	
R29	47 k $\Omega$ 1%	
R30	10 k $\Omega$ 1%	
R31	10 k $\Omega$ 1%	
R32	100 $\Omega$	
R33	12,4 k $\Omega$ 1%	
R34	10 k $\Omega$ 1%	
R35	1 k $\Omega$ 1%	
R36	47 k $\Omega$ 1%	

##### Optoresistor

LDR1 VTL5C4

##### Transistors

Q1	BC 547
Q2	BC 557
Q3	Q 4015R6

##### Capacitors

C1	-
C2	-
C3	330 nF 50V
C4	10 $\mu$ F 50V
C5	10 $\mu$ F 50V
C6	220 pF 5% *
C7	220 pF 5% *
C8	330 pF 5% *
C9	100 pF 5% *
C10	0.47 $\mu$ F 50V
C11	-
C12	22 $\mu$ F 50V
C13	22 $\mu$ F 50V
C14	0.47 $\mu$ F 250V
C15	2.2 $\mu$ F 63V
C16	22 $\mu$ F 50V
C17	22 $\mu$ F 50V
C18	-
C19	22 pF
C20	22 $\mu$ F 50V
C21	22 $\mu$ F 50V

##### Diodes

D1	DB 3 *
D2	1N 4148
D3	1N 4148
D4	1N 4148
D5	1N 4148

##### Switches

S1	Alps SPPJ3
S2	Alps "

##### Integrated circuits

U1	NE 5532
U2	NE 5532
U3	LF 353
U4	LF 353

##### Connectors

K1	3-pole XLR chassie
K2	3-pole Telejack
K4	5-pole pinheader

##### Resistors

R201	10 $\Omega$
R202	220 k $\Omega$

R203	1 k $\Omega$ 1%
R204	2.2 k $\Omega$
R205	2,2 k $\Omega$ 1%
R206	22 k $\Omega$ 1%

##### Capacitors

C201	22 pF
C202	220 pF
C203	68 pF
C204	10 $\mu$ F 25V
C205	1 nF
C206	68 pF 5%
C207	220 pF

##### Trim capacitors

CT201 2-22pF

##### Diodes

D201	1N 5404
D202	1N 5404
D203	5.6V Zener 2%

##### Transistors

Q201	BC 547
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##### Integrated circuits

U201	74HC74
U202	LM 318

##### Crystals

X201	2,4576 MHz
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##### Switches

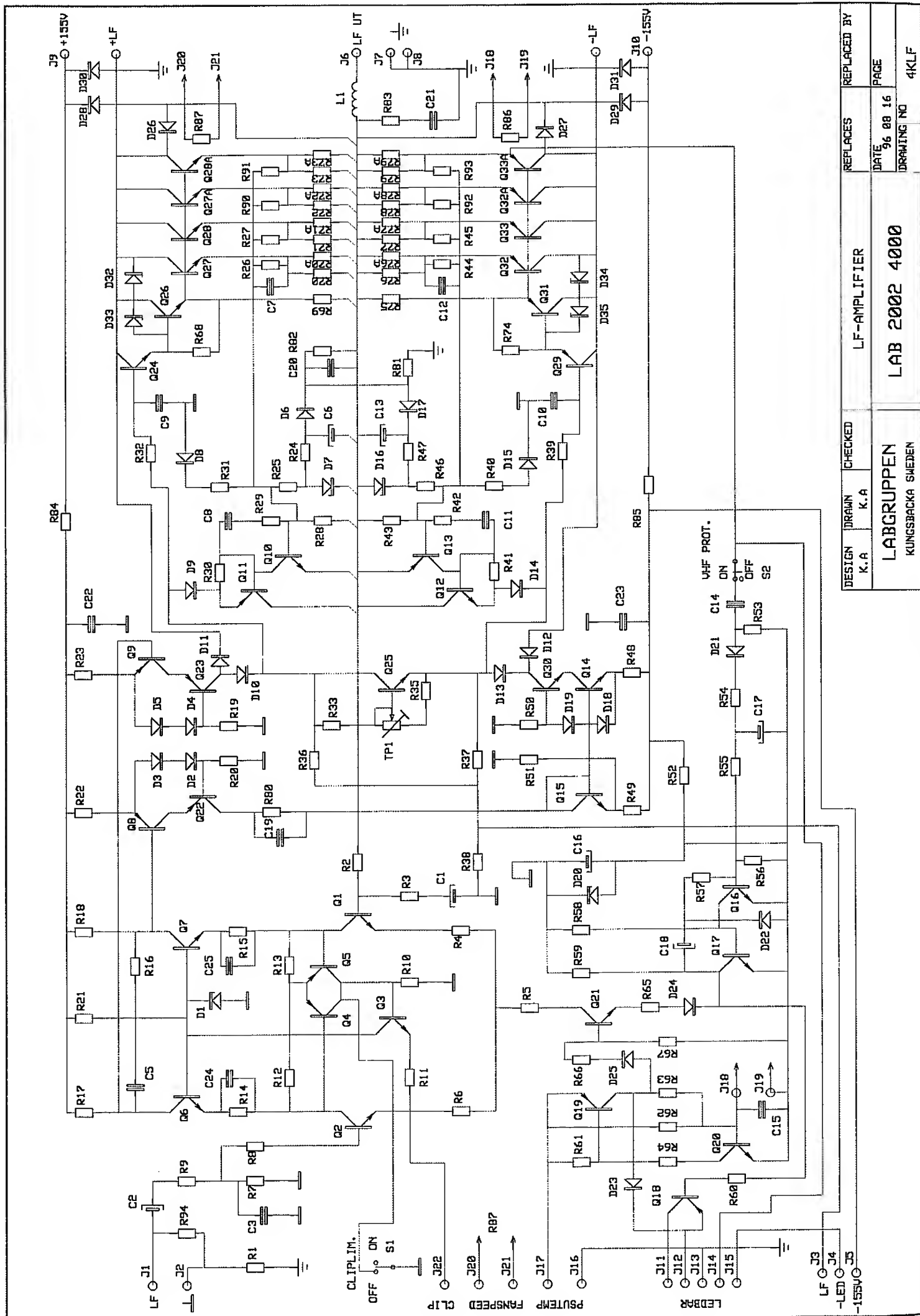
S201	Alps SPPJ3
S202	Alps "
S203	Alps "

##### INTERNAL CONNECTIONS

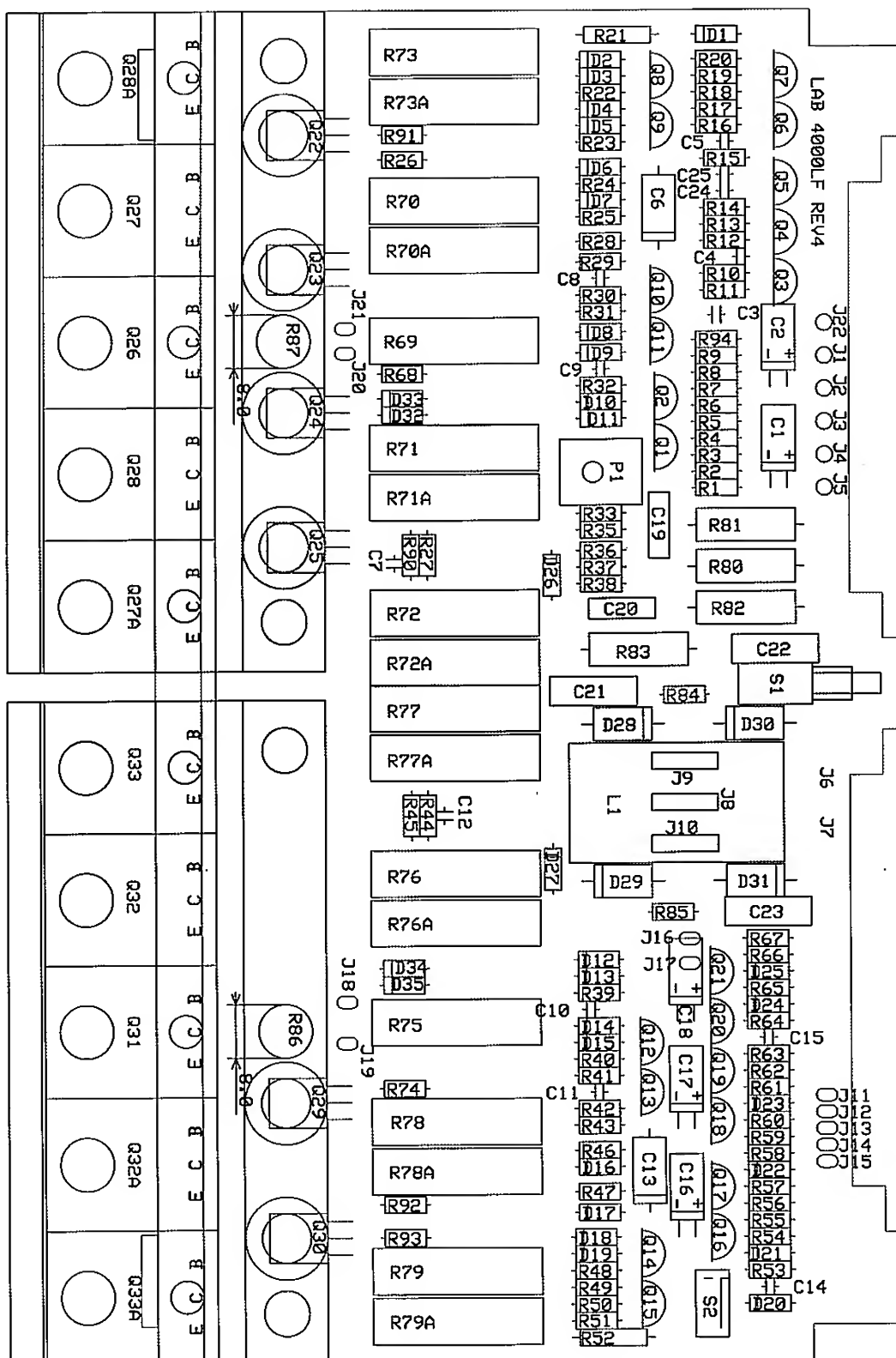
RA	10 k $\Omega$ 1%
P1	10 k $\Omega$ lin Tokos
K3	Speak-on NL-4MP

##### Inductors

L1	9.5 $\mu$ H (2 core)
L2	9.5 $\mu$ H (2 core)



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K.A	K.A		LF-AMPLIFIER	
LABGRUPPEN			DATE	PAGE
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LAB 2002 4000			DRAWING NO	4KLF





# LAB 4000

## LF-AMPLIFIER

### Component-list

**Resistors**

R1	10 $\Omega$
R2	27 k $\Omega$ 1%
R3	806 $\Omega$ 1%
R4	180 $\Omega$ 1%
R5	1.8 k $\Omega$ 1%
R6	180 $\Omega$ 1%
R7	27 k $\Omega$ 1%
R8	10 $\Omega$
R9	1 k $\Omega$ 1%
R10	100 k $\Omega$ 1%
R11	1.8 k $\Omega$ 1%
R12	27 k $\Omega$ 1%
R13	27 k $\Omega$ 1%
R14	3.3 k $\Omega$ 1%
R15	3.3 k $\Omega$ 1%
R16	4.7 k $\Omega$ 1%
R17	3.3 k $\Omega$ 1%
R18	3.3 k $\Omega$ 1%
R19	100 k $\Omega$ 1%
R20	100 k $\Omega$ 1%
R21	18 k $\Omega$ 2W
R22	100 $\Omega$ 1%
R23	100 $\Omega$ 1%
R24	56 k $\Omega$ 1%
R25	68 k $\Omega$ 1%
R26	12.4 k $\Omega$ 1%
R27	12.4 k $\Omega$ 1%
R28	3.9 k $\Omega$ 1%
R29	10 k $\Omega$ 1%
R30	4.7 k $\Omega$ 1%
R31	560 k $\Omega$ 1%
R32	220 $\Omega$
R33	3.3 k $\Omega$ 1%
R34	-
R35	604 $\Omega$ 1%
R36	100 k $\Omega$ 1% 0.7W
R37	100 k $\Omega$ 1% 0.7W
R38	820 k $\Omega$
R39	220 $\Omega$
R40	560 k $\Omega$ 1%
R41	4.7 k $\Omega$ 1%
R42	10 k $\Omega$ 1%
R43	3.9 k $\Omega$ 1%
R44	12.7 k $\Omega$ 1%
R45	12.7 k $\Omega$ 1%
R46	68 k $\Omega$ 1%
R47	56 k $\Omega$ 1%
R48	100 $\Omega$ 1%
R49	100 $\Omega$ 1%
R50	100 k $\Omega$ 1%
R51	100 k $\Omega$ 1%
R52	18 k $\Omega$ 2W
R53	10 k $\Omega$ 1%
R54	10 k $\Omega$ 1%
R55	220 k $\Omega$ 1%

R56	100 k $\Omega$ 1%
R57	220 k $\Omega$ 1%
R58	56 k $\Omega$ 1%
R59	56 k $\Omega$ 1%
R60	27 k $\Omega$ 1%
R61	3.3 k $\Omega$ 1%
R62	432 k $\Omega$ 1%
R63	2.2 M $\Omega$
R64	27 k $\Omega$ 1%
R65	2.7 k $\Omega$ 1%
R66	100 k $\Omega$ 1%
R67	56 k $\Omega$ 1%
R68	47 $\Omega$
R69	4.7 $\Omega$ 5W
R70	0.33 $\Omega$ 5W
R70a	0.33 $\Omega$ 5W
R71	0.33 $\Omega$ 5W
R71a	0.33 $\Omega$ 5W
R72	0.33 $\Omega$ 5W
R72a	0.33 $\Omega$ 5W
R73	0.33 $\Omega$ 5W
R73a	0.33 $\Omega$ 5W
R74	47 $\Omega$
R75	4.7 $\Omega$ 5W
R76	0.33 $\Omega$ 5W
R76a	0.33 $\Omega$ 5W
R77	0.33 $\Omega$ 5W
R77a	0.33 $\Omega$ 5W
R78	0.33 $\Omega$ 5W
R78a	0.33 $\Omega$ 5W
R79	0.33 $\Omega$ 5W
R79a	0.33 $\Omega$ 5W
R80	6.8 k $\Omega$ 3W
R81	820 $\Omega$ 6W
R82	1.5 k $\Omega$ 3W
R83	10 $\Omega$ 3W
R84	10 $\Omega$
R85	10 $\Omega$
R86	150 k $\Omega$ NTC
R87	150 k $\Omega$ NTC
R88	-
R89	-
R90	12.4 k $\Omega$ 1%
R91	12.4 k $\Omega$ 1%
R92	12.4 k $\Omega$ 1%
R93	12.4 k $\Omega$ 1%
R94	27 k $\Omega$ 1%

**Trim potentiometers**

TP1	250 $\Omega$
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**Capacitors**

C1	220 $\mu$ F 16V
C2	10 $\mu$ F 50V
C3	150 pF ker

C4	-
C5	680 pF
C6	1 $\mu$ F 100V
C7	1 nF 63V
C8	1 nF 63V
C9	680 pF
C10	680 pF
C11	1 nF 63V
C12	1 nF 63V
C13	1 $\mu$ F 100V
C14	39 pF 500V
C15	0.1 $\mu$ F 40V
C16	220 $\mu$ F 16V
C17	4.7 $\mu$ F 50V
C18	10 $\mu$ F 50V
C19	22 nF 250V
C20	47 nF 250V
C21	0.1 $\mu$ F 250V
C22	0.1 $\mu$ F 250V
C23	0.1 $\mu$ F 250V
C24	4.7 nF
C25	4.7 nF
C26	-
C27	-

**Diodes**

D1	15 V Zener
D2	1N 4148
D3	1N 4148
D4	1N 4148
D5	1N 4148
D6	1N 4004
D7	27 V Zener
D8	BAV 21
D9	1N 4148
D10	1N 4148
D11	BAV 21
D12	BAV 21
D13	1N 4148
D14	1N 4148
D15	BAV 21
D16	27 V Zener
D17	1N 4004
D18	1N 4148
D19	1N 4148
D20	15 V Zener
D21	1N 4004
D22	1N 4148
D23	1N 4148
D24	1N 4148
D25	1N 4148
D26	1N 4004
D27	1N 4004
D28	BYW 96E
D29	BYW 96E
D30	1N 5404
D31	1N 5404

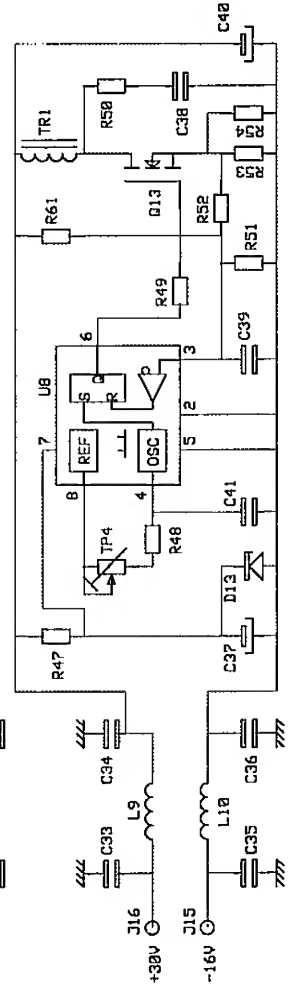
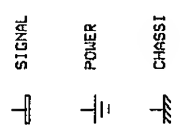
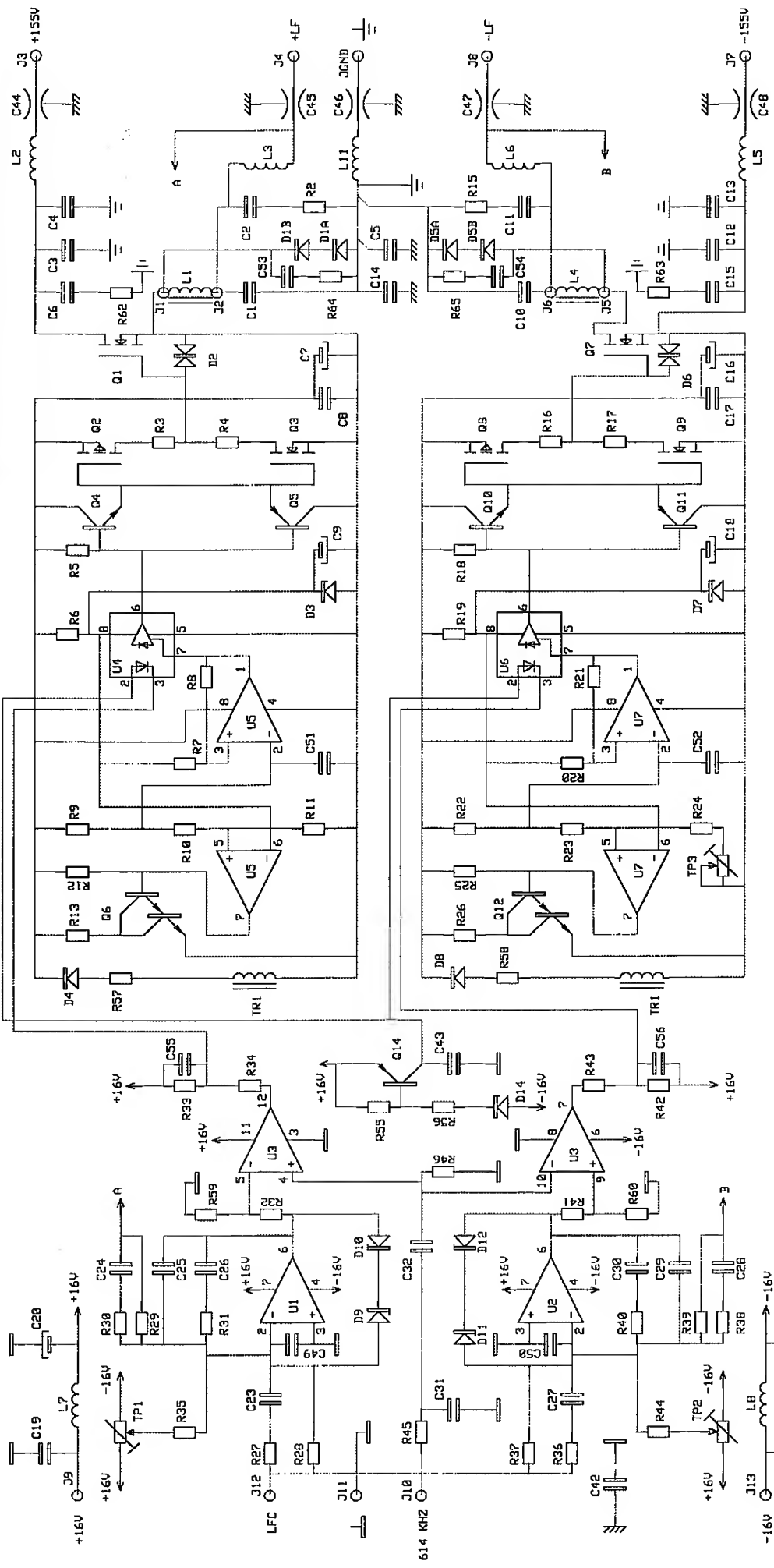
D32	BZX85C100
D33	BZX85C100
D34	BZX85C100
D35	BZX85C100

**Transistors**

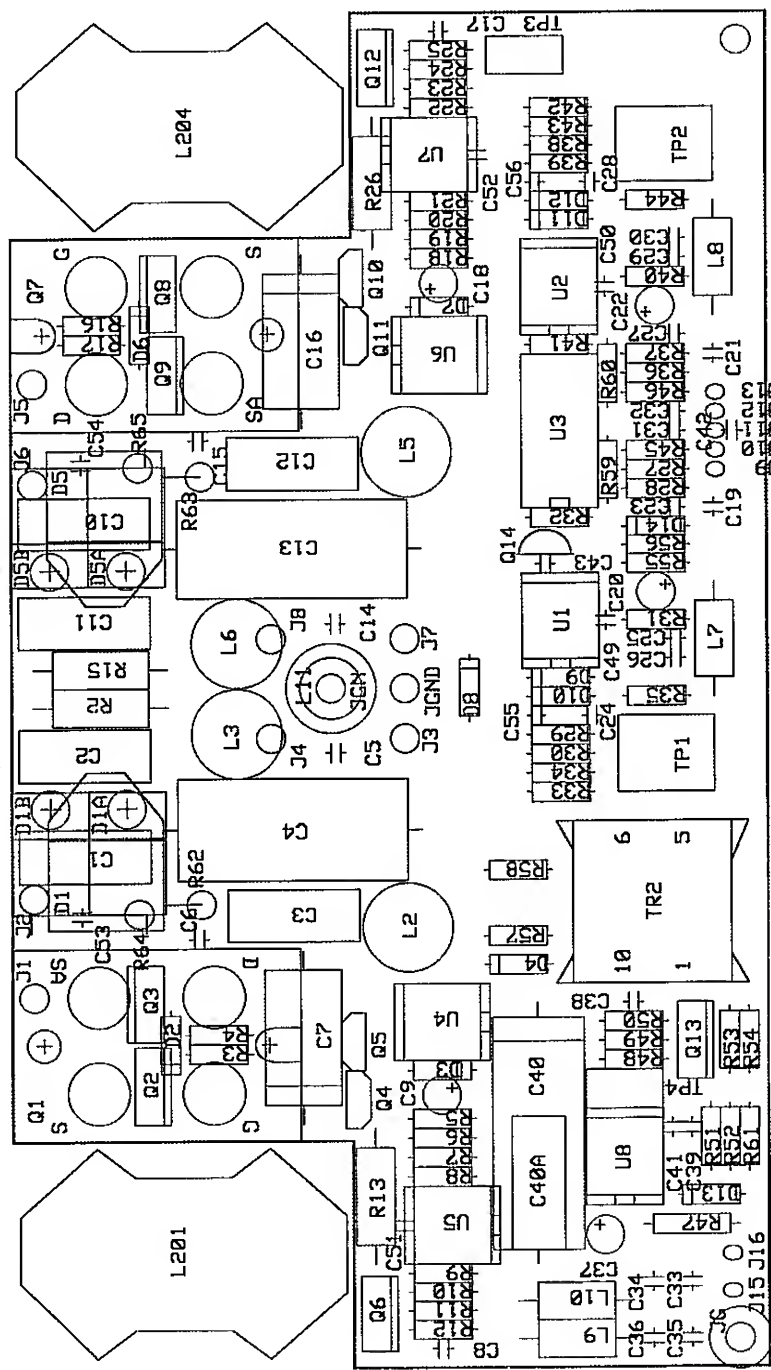
Q1	BC 549C matched
Q2	BC 549C matched
Q3	BC 547
Q4	BC 557
Q5	BC 557
Q6	MPSA 42
Q7	MPSA 42
Q8	BC 557
Q9	BC 557
Q10	BC 547
Q11	BC 557
Q12	BC 547
Q13	BC 557
Q14	BC 547
Q15	BC 547
Q16	BC 547
Q17	BC 547
Q18	BC 557
Q19	BC 557
Q20	BC 547
Q21	BC 547
Q22	MJE 350
Q23	MJE 350
Q24	MJE 340
Q25*	BD329
Q26	MJL 21194
Q27	MJL 21194
Q27a	MJL 21194
Q28	MJL 21194
Q28a	MJL 21194
Q29	MJE 350
Q30	MJE 340
Q31	MJL 21193
Q32	MJL 21193
Q32a	MJL 21193
Q33	MJL 21193
Q33a	MJL 21193

**Switches**

S1	SPPJ3 Alps
S2	Dipfix Siemens
* Until 9801	
R35	750 $\Omega$ 1%
Q25	MJE 340



DESIGN	DRAWN	CHECKED	REPLACES	REPLACED BY
K. A	K. A		96 08 20	
LABGRUPPEN			DATE	PAGE
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LAB 2002 4000			DRAWING NO	



DESIGN K.A	DRAWN K.A	CHECKED	HF AMPLIFIER	REPLACES	REPLACED BY
LABGRUPPEN KUNGSBACKA SWEDEN			LAB2002 LAB4000	DATE	PAGE
				99 09 18	
				DRAWING NO	4KHFR1-P

LABGRUPPEN  
KUNGSBACKA SWEDEN

# LAB 4000

## HF-AMPLIFIER

### Component-list

#### Resistors

R1	-
R2	2,2 $\Omega$ 2W on legs
R3	4,7 $\Omega$
R4	1 $\Omega$ 1W on legs
R5	680 $\Omega$
R6	47 $\Omega$
R7	2,2 k $\Omega$ 1%
R8	22 k $\Omega$
R9	820 $\Omega$
R10	47 $\Omega$
R11	2,2 k $\Omega$ 1%
R12	4,7 k $\Omega$ 1%
R13	15 $\Omega$ 6W on legs
R14	-
R15	2,2 $\Omega$ 2W on legs
R16	4,7 $\Omega$
R17	1 $\Omega$ 1W on legs
R18	680 $\Omega$
R19	47 $\Omega$
R20	2,2 k $\Omega$ 1%
R21	22 k $\Omega$
R22	820 $\Omega$
R23	47 $\Omega$
R24	1,8 k $\Omega$ 1%
R25	4,7 k $\Omega$ 1%
R26	15 $\Omega$ 6W on legs
R27	1,5 k $\Omega$ 1%
R28	1,8 k $\Omega$ 1%
R29	27 k $\Omega$ 1%
R30	2,2 k $\Omega$ 1%
R31	6,8 k $\Omega$ 1%
R32	4,7 k $\Omega$
R33	330 $\Omega$
R34	1,2 k $\Omega$
R35	56 k $\Omega$ 1%
R36	1,5 k $\Omega$ 1%
R37	1,8 k $\Omega$ 1%
R38	2,2 k $\Omega$ 1%
R39	27 k $\Omega$ 1%
R40	6,8 k $\Omega$ 1%
R41	4,7 k $\Omega$ 1%
R42	330 $\Omega$
R43	1,2 k $\Omega$
R44	56 k $\Omega$ 1%
R45	2,2 k $\Omega$ 1%
R46	2,2 k $\Omega$ 1%
R47	1,2 k $\Omega$ 3W
R48	12 k $\Omega$
R49	47 $\Omega$
R50	27 $\Omega$ 1% on legs
R51	1 k $\Omega$ 1%
R52	1 k $\Omega$ 1%

R53	2,2 $\Omega$
R54	2,2 $\Omega$
R55	2,2 k $\Omega$ 1%
R56	2,2 k $\Omega$ 1%
R57	1 $\Omega$ 1W on legs
R58	1 $\Omega$ 1W on legs
R59	2,2 k $\Omega$ 1%
R60	2,2 k $\Omega$ 1%
R61	120 k $\Omega$ 1%
R62	2,2 $\Omega$ 2W on legs
R63	2,2 $\Omega$ 2W on legs
R64	2,2 $\Omega$ 2W on legs
R65	2,2 $\Omega$ 2W on legs

#### Trim potentiometers

TP1	25 k $\Omega$
TP2	25 k $\Omega$
TP3	1 k $\Omega$
TP4	10 k $\Omega$

#### Capacitors

C1	0,33 $\mu$ F 250V
C2	0,33 $\mu$ F 250V
C3	0,33 $\mu$ F 250V
C4	4,7 $\mu$ F 160V
C5	1 $\mu$ F 63V
C6	4,7 nF 200V NP0
C7	470 $\mu$ F 10V
C8	0,1 $\mu$ F 63V
C9	10 $\mu$ F 50V
C10	0,33 $\mu$ F 250V
C11	0,33 $\mu$ F 250V
C12	0,33 $\mu$ F 250V
C13	4,7 $\mu$ F 160V
C14	1 $\mu$ F 63V
C15	4,7 nF 200V NP0
C16	470 $\mu$ F 10V
C17	0,1 $\mu$ F 63V
C18	10 $\mu$ F 50V
C19	0,1 $\mu$ F 63V
C20	10 $\mu$ F 50V
C21	0,1 $\mu$ F 63V
C22	10 $\mu$ F 50V
C23	2,2 nF 5%
C24	100 pF 5%
C25	39 pF 5%
C26	270 pF 5%
C27	2,2 nF 5%
C28	100 pF 5%
C29	39 pF 5%
C30	270 pF 5%
C31	68 pF

C32	1 nF
C33	0,1 $\mu$ F 63V
C34	0,1 $\mu$ F 63V
C35	0,1 $\mu$ F 63V
C36	0,1 $\mu$ F 63V
C37	10 $\mu$ F 50V
C38	1 nF/100V/5/NP0
C39	220 pF
C40	2,2 $\mu$ F 100V
C41	1 nF NP0
C42	0,1 $\mu$ F 63V ker
C43	-
C44	1,5 nF feed through
C45	1,5 nF feed through
C46	1,5 nF feed through
C47	1,5 nF feed through
C48	1,5 nF feed through
C49	220 pF
C50	220 pF
C51	1 nF
C52	1 nF
C53	470 pF 200V NP0
C54	470 pF 200V NP0

#### Diodes

D1a	BYW 81PI200
D1b	BYW 81PI200
D2	BZW 06P15B
D3	5,6V Zener 2%
D4	BYV 100-100
D5a	BYW 81PI200
D5b	BYW 81PI200
D6	BZW 06P15B
D7	5,6V Zener 2%
D8	BYV 100-100
D9	12V Zener
D10	12V Zener
D11	12V Zener
D12	12V Zener
D13	18V Zener 1,3W
D14	27V Zener

#### Transistors

Q1	IXFN 73N30
Q2	MTP2955V
Q3	BUZ 71
Q4	ZTX 650
Q5	ZTX 750
Q6	Tip 120

Q7	IXFN 73N30
Q8	MTP2955V
Q9	BUZ 71
Q10	ZTX 650
Q11	ZTX 750
Q12	Tip 120
Q13	IRF 730
Q14	BC 557

#### Integrated circuits

U1	LM 318
U2	LM 318
U3	LM 319
U4	HCPL 2400
U5	LM 393
U6	HCPL 2400
U7	LM 393
U8	UC 3843

#### Inductors

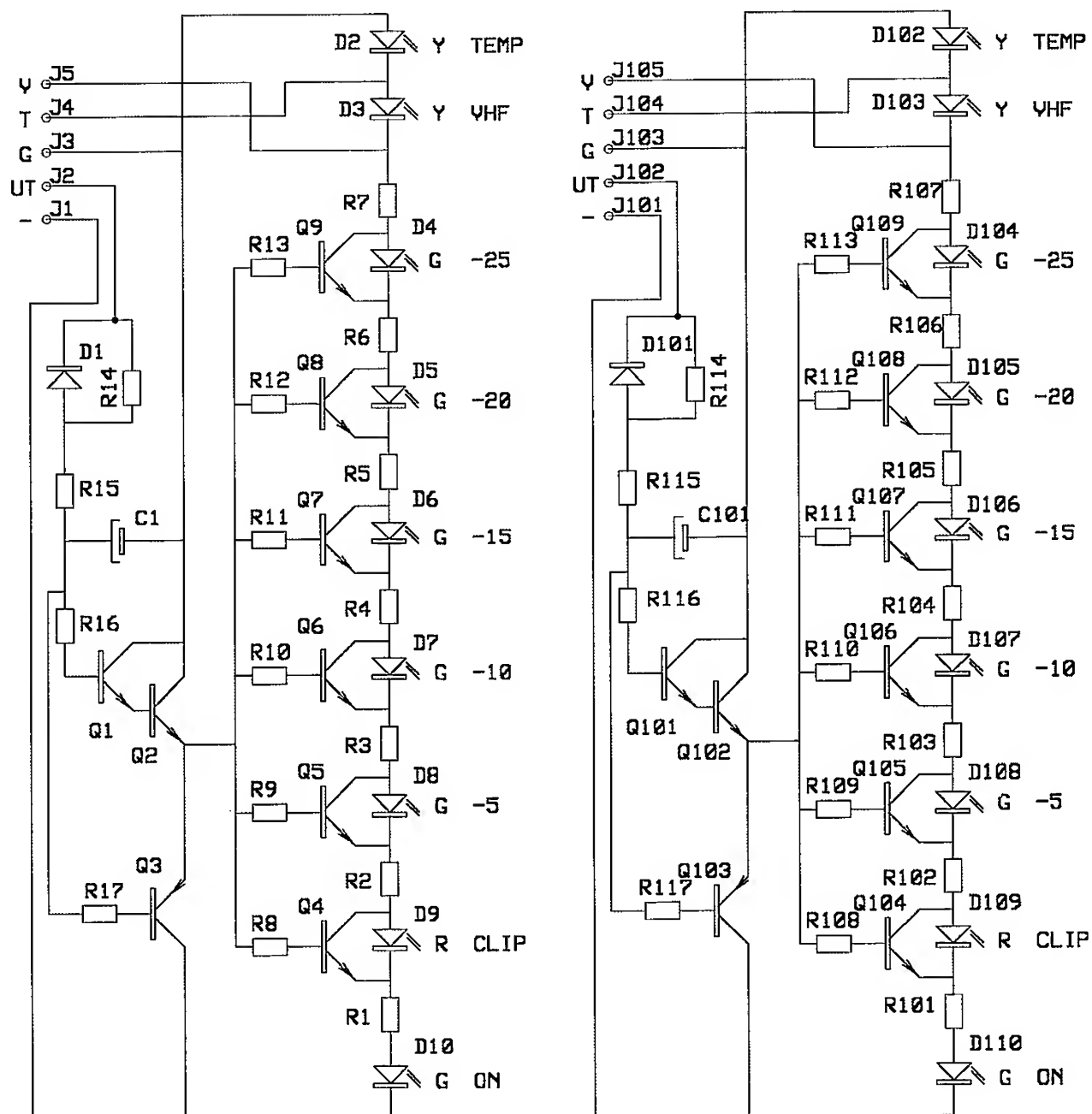
L1	14 $\mu$ H
L2	1 $\mu$ H
L3	1 $\mu$ H
L4	14 $\mu$ H
L5	1 $\mu$ H
L6	1 $\mu$ H
L7	47 $\mu$ H
L8	47 $\mu$ H
L9	47 $\mu$ H
L10	47 $\mu$ H
L11	1 $\mu$ H

#### Transformers

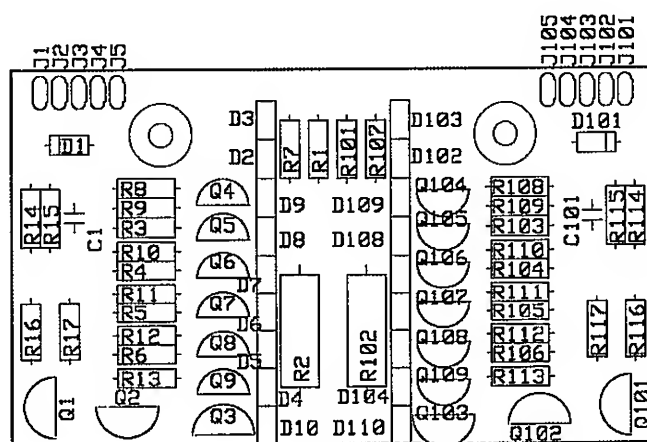
TR1	EF20 N27
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CHA

CHB



DESIGN K.A	DRAWN K.A	CHECKED	LED.DISPLAY	REPLACES	REPLACED BY
LABGRUPPEN			LAB500 1000 1300	DATE 90 12 01	PAGE
KUNGSBACKA SWEDEN			1600 2000 4000	DRAWING NO	2KLED



DESIGN K.A	DRAWN K.A	CHECKED	LED DISPLAY	REPLACES	REPLACED BY
LABGRUPPEN KUNGSBACKA SWEDEN			LAB500 1000 1300 1600 2000 4000	DATE 99 09 18	PAGE
				DRAWING NO	LEDRA-P

# LAB 4000

## LED DISPLAY

### Component-list

Channel A  
(Ch. B add 100)

#### Resistors

R1 1,2 k $\Omega$  1%  
R2 4,7 k $\Omega$  3W  
R3 2,2k $\Omega$  1%  
R4 1,2 k $\Omega$  1%  
R5 560  $\Omega$   
R6 220  $\Omega$   
R7 390  $\Omega$   
R8 56 k $\Omega$   
R9 56 k $\Omega$   
R10 56 k $\Omega$   
R11 56 k $\Omega$   
R12 56 k $\Omega$   
R13 56 k $\Omega$   
R14 56 k $\Omega$   
R15 220  $\Omega$   
R16 2.7 k $\Omega$   
R17 2.7 k $\Omega$

#### Capacitors

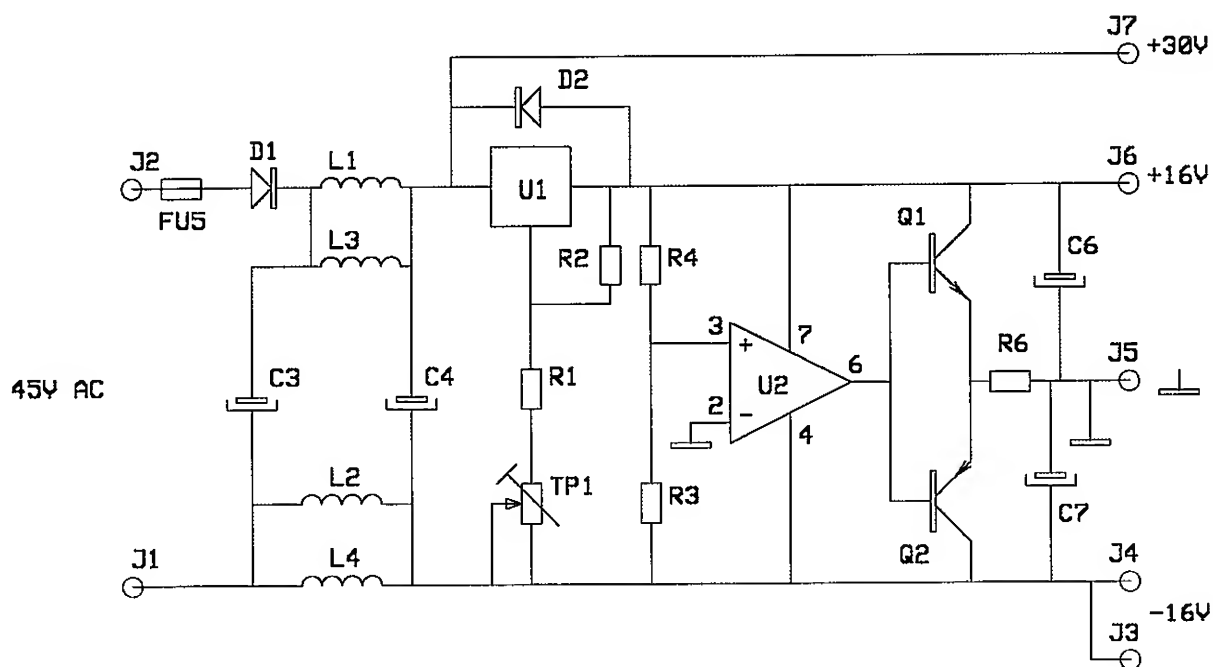
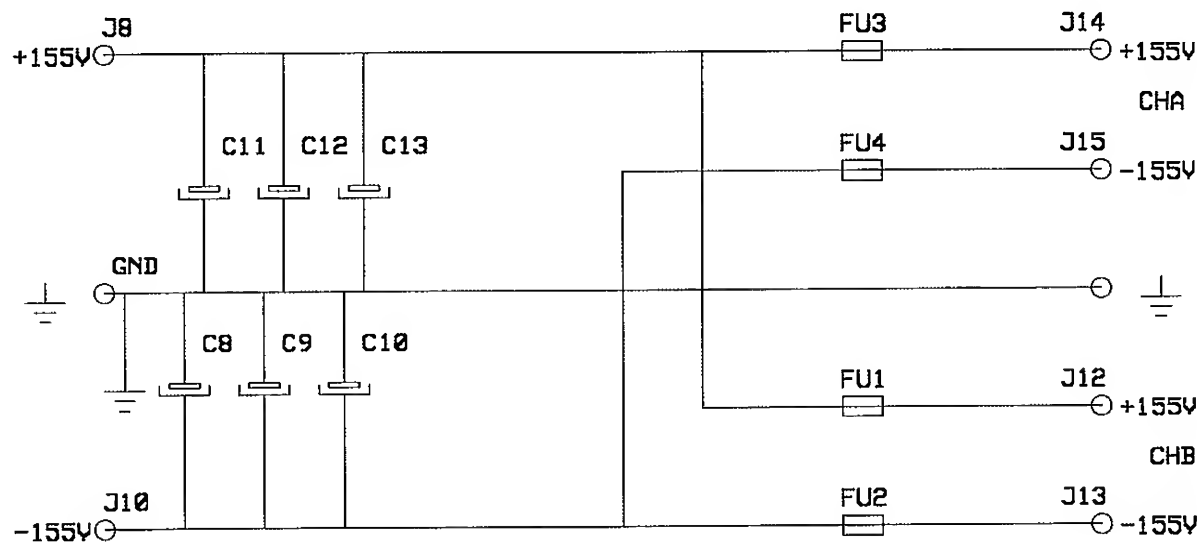
C1 2,2  $\mu$ F 160V

#### Diodes

D1 IN 4004  
D2 Led Y  
D3 Led Y  
D4 Led G  
D5 Led G  
D6 Led G  
D7 Led G  
D8 Led G  
D9 Led R  
D10 Led G

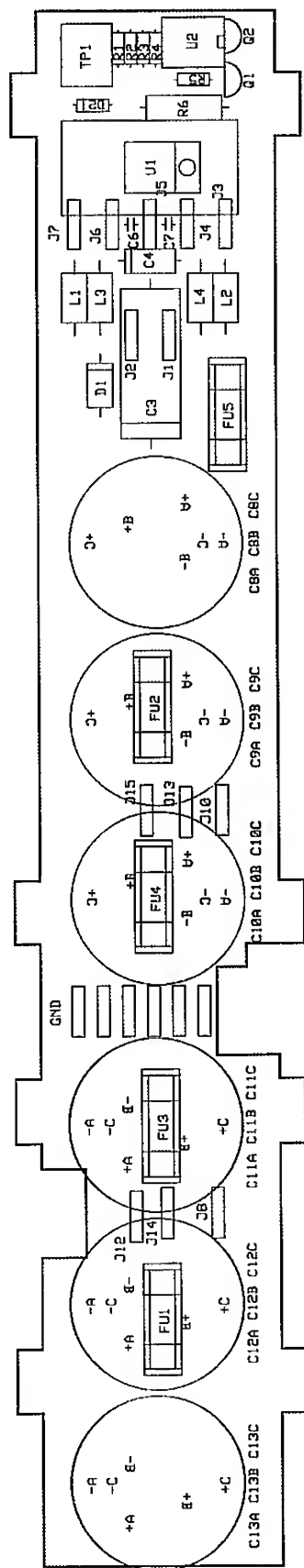
#### Transistors

Q1 MPSA 42  
Q2 MPSA 42  
Q3 MPSA 92  
Q4 BC 547  
Q5 BC 547  
Q6 BC 547  
Q7 BC 547  
Q8 BC 547  
Q9 BC 547



DESIGN K.A	DRAWN K.A	CHECKED	FUSE-BOARD VOLTAGESTABB.-BOARD	REPLACES	REPLACED BY
LABGRUPPEN KUNGSBACKA SWEDEN			LAB 4000	DATE 96 08 01	PAGE
				DRAWING NO 4KFU	





DESIGN	DRAWN	CHECKED	REPLACES	REPLACED BY
K.A	K.A		FUSE BOARD, VOLTAGE STAB. BOARD	
LABGRUPPEN			DATE	PAGE
KLINGSBACKA SWEDEN			99 09 18	
LAB2000 2002 4000			DRAWING NO	2KFUC-P

# LAB 4000

## FUSE, VOLTAGESTABB. BOARD

### component-list

**Resistors**

R1 5.6 k $\Omega$   
 R2 270  $\Omega$   
 R3 10 k $\Omega$  1%  
 R4 10 k $\Omega$  1%  
 R5 1 k $\Omega$   
 R6 150  $\Omega$  3W

**Fuses**

FU1 F 15A  
 FU2 F 15A  
 FU3 F 15A  
 FU4 F 15A

**Inductors**

L1 47  $\mu$ H  
 L2 47  $\mu$ H  
 L3 47  $\mu$ H  
 L4 47  $\mu$ H

**Trim potentiometers**

TP1 2.5 k $\Omega$

**Capacitors**

C1 -  
 C2 -  
 C3 470  $\mu$ F 100V (ASM021)  
 C4 22  $\mu$ F 100V (ASM021)  
 C5 -  
 C6 22  $\mu$ F 50V  
 C7 22  $\mu$ F 50V  
 C8 2200  $\mu$ F 160V  
 C9 2200  $\mu$ F 160V  
 C10 2200  $\mu$ F 160V  
 C11 2200  $\mu$ F 160V  
 C12 2200  $\mu$ F 160V  
 C13 2200  $\mu$ F 160V

**Diodes**

D1 BYW 98-200  
 D2 1N 4004

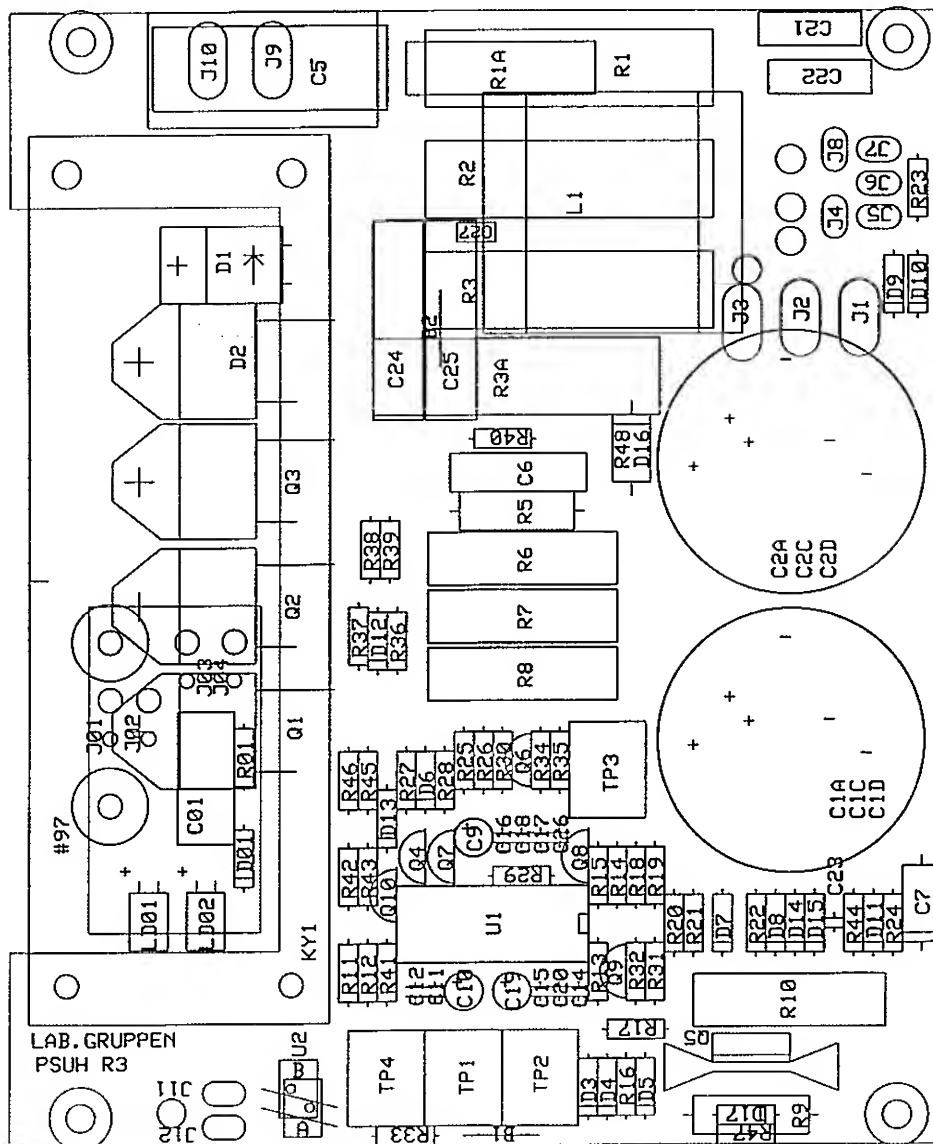
**Transistors**

Q1 BC 337  
 Q2 BC 327

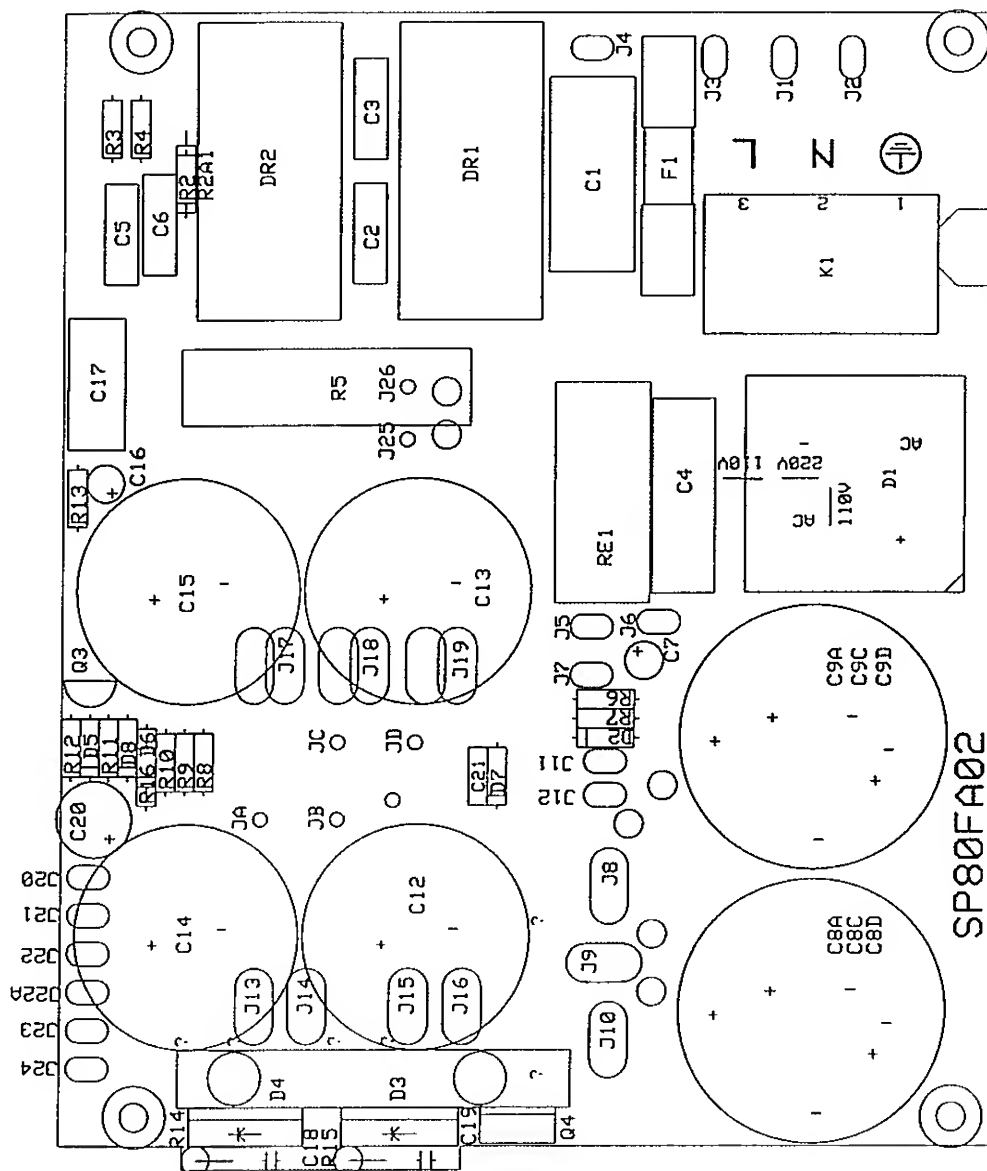
**Integrated circuits**

U1 LM 317  
 U2 uA 741





DESIGN K.A	DRAWN K.A	CHECKED	POWER SUPPLY H	REPLACES 99 09 18	REPLACED BY
LABGRUPPEN KUNGSBACKA SWEDEN			LAB 1200 1300 1600	DATE 00 03 02	PAGE
			2000C 2002 4000 PSU48	DRAWING NO	
					PSUHR3-P



DESIGN K.A	DRAWN K.A	CHECKED	POWER SUPPLY SP80FA	REPLACES 01 04 13	REPLACED BY
LABGRUPPEN KUNGSBACKA SWEDEN			LAB 1200 1300 1600 2000C 2002 4000 PSU48	DATE 01 05 04	PAGE
				DRAWING NO	SP80FA02-P

## POWER SUPPLY, BOARD PSUG

### component-list

#### Resistors

R1-  
R2 1 M $\Omega$  1%  
R3 33  $\Omega$   
R4 33  $\Omega$   
R5# 47  $\Omega$  9W  
R6 33  $\Omega$   
R7 2.2  $\Omega$  1W  
R8 See below  
R9 See below  
R10 See below  
R11 See below  
R12 See below  
R13 4.7  $\Omega$   
R14 See below  
R15 See below  
R16 See below

#### Capacitors

C1 0.47 $\mu$ F  
C2# 1.5 nF Y  
C3# 1.5 nF Y  
C4 0.22 $\mu$ F  
C5# 1.5 nF Y  
C6# 1.5 nF Y  
C7 100 $\mu$ F 50V  
C8a# See below  
C9a# See below

C12 See below  
C13 See below  
C14 See below  
C15 See below  
C16 22 $\mu$ F 16V  
C17 2.2 $\mu$ F 63V  
C18 See below  
C19 See below  
C20 See below  
C21 See below

#### Diodes

D1 600V 35A  
D2 BYW26C  
D3 STTB3006PI  
D4 STTB3006PI  
D5 5.6V Zener  
D6 See below  
D7 See below  
D8 See below

#### Transistors

Q3 BC 546  
Q4 See below

#### Relays

RE1 FEME MZF 0014816

#### Fuses

FU1 See below

#### Coils

DR1# See below  
DR2# See below

#### Switches

S1# See below  
S2# See below  
S3 Comepa 4JT95 ARIUI 95°C

#### Relays

RE1 FEME MZF 0014816

#### Socket

K1 MKDSP10/3-10,16

#### # 110V AC

R5 22  $\Omega$  9W  
C2 2,2 nF Y  
C3 2,2 nF Y  
C5 2,2 nF Y  
C6 2,2 nF Y

\* Until 9708  
Q4 BDX53F  
D7 -  
D8 -

## POWER SUPPLY, BOARD PSUG

	LAB 1200C	LAB 1300C	LAB 1600	LAB 2000C	LAB 4000	PSU48-8
R8	4.7 k $\Omega$ 1%	Jumper	8.2 k $\Omega$ 1%	Jumper	27 k $\Omega$ 1% long leg	4,7 k $\Omega$ 1%
R9	1 M $\Omega$	470 k $\Omega$	150 k $\Omega$	390 k $\Omega$	180 k $\Omega$ 1%	470 k $\Omega$
R10	39 k $\Omega$ 1%	4.7 k $\Omega$ 1% long leg	39 k $\Omega$ 1%	47 k $\Omega$ 1%	39 k $\Omega$ 1%	10 k $\Omega$ 1%
R11	18 k $\Omega$ 1%	1.8 k $\Omega$	18 k $\Omega$ 1%	6.8 k $\Omega$	18 k $\Omega$ 1%	4,7 k $\Omega$ 1%
R12	4.7 k $\Omega$ 1%	Jumper	4.7 k $\Omega$	1.8 k $\Omega$	4.7 k $\Omega$ 1%	Jumper
R14	2.2 $\Omega$ 2W	-	2.2 $\Omega$ 2W	-	-	-
R15	2.2 $\Omega$ 2W	-	2.2 $\Omega$ 2W	-	-	-
R16	-	18 k $\Omega$ 1%	-	39 k $\Omega$ 1%	-	-
C8a	220uF 385V	220uF 385V	220uF 385V	220uF 385V		220uF 385V
C9a	220uF 385V	220uF 385V	220uF 385V	220uF 385V		220uF 385V
C8b	-	-	-	-	1500 uF 200V	-
C9b	-	-	-	-	1500 uF 200V	-
C12	3900 uF 100V	3900 uF 100V	3900 uF 100V	1800 uF 160V	1800 uF 160V	3900 uF 100V
C13	3900 uF 100V	3900 uF 100V	3900 uF 100V	1800 uF 160V	1800 uF 160V	3900 uF 100V
C14	3900 uF 100V	3900 uF 100V	3900 uF 100V	1800 uF 160V	1800 uF 160V	3900 uF 100V
C15	3900 uF 100V	3900 uF 100V	3900 uF 100V	1800 uF 160V	1800 uF 160V	3900 uF 100V
C18	4.7 nF 400V	-	4.7 nF 400V	-	-	-
C19	4.7 nF 400V	-	4.7 nF 400V	-	-	-
C20	100 uF 50V	100 uF 50V	100 uF 50V	100 uF 50V	100 uF 50V	-
C21	-	-	-	680 pF/400V	680 pF/400V	-
D6	62 V $\pm$ 2% Zener	-	62 V $\pm$ 2% Zener	-	62 V $\pm$ 2% Zener	27V Zener
D7	-	-	-	15V Zener	15V Zener	-
D8	-	-	-	39V $\pm$ 2% Zener	39V $\pm$ 2% Zener	-
Q4	TIP132	TIP41	TIP132	*IRF730	*IRF730	BDX53F
F1	T10AH250V	T8AH250V	T10AH250V	T10AH250V	T15AH250V	T10AH250V
DR1	2.7mH 8A 220V	2.7mH 8A 220V	2.7mH 8A 220V	2.7mH 8A 220V	1.4mH 16A 110V	2.7mH 8A 220V
DR2	2.7mH 8A 220V	2.7mH 8A 220V	2.7mH 8A 220V	2.7mH 8A 220V	1.4mH 16A 110V	2.7mH 8A 220V
S1	8550VB	8550VB	8550VB	8550VB	Jumper	8550VB
S2	-	-	-	-	H8610VBBB	-
B1	JB-JC, D1,2	-	-	-	-	-
B2	-	-	-	-	-	JA-JB, D1,2
B3	-	-	-	-	-	JC-JD, D1,2
B4	J5-J6	J5-J6	J5-J6	J5-J6	-	J5-J6
B5#	Rectifier 220V	Rectifier 220V	Rectifier 220V	Rectifier 220V	Rectifier 220V	Rectifier 220V

## # 110V

C8b#	1500 uF 200V	1500 uF 200V	1500 uF 200V	1500 uF 200V	-	1500 uF 200V
C9b#	1500 uF 200V	1500 uF 200V	1500 uF 200V	1500 uF 200V	-	1500 uF 200V
C8d#	-	-	-	-	2200 uF 200V	-
C9d#	-	-	-	-	2200 uF 200V	-
F1#	T20A	T20A	T20A	T20A	T30A	T20A
DR1#	1.4mH16A110V	1.4mH16A110V	1.4mH16A110V	1.4mH16A110V	1.4mH25A110V	1.4mH16A110V
DR2#	1.4mH25A110V	1.4mH16A110V	1.4mH16A110V	1.4mH16A110V	1.4mH25A110V	1.4mH16A110V
S1	Jumper	Jumper	Jumper	Jumper	Jumper	Jumper
S2#	H8610VBBB	H8610VBBB	H8610VBBB	H8610VBBB	H8610VBBB	H8610VBBB
B5	Rectifier 110V	Rectifier 110V	Rectifier 110V	Rectifier 110V	Rectifier 110V	Rectifier 110V
B6	Rectifier 110V	Rectifier 110V	Rectifier 110V	Rectifier 110V	Rectifier 110V	Rectifier 110V

## POWER SUPPLY, BOARD PSUH

### component-list

#### Resistors

R1 See below  
 R2 See below  
 R3 See below  
 R4 -  
 R5 See below  
 R6 0.1  $\Omega$  4W  
 R7 0.1  $\Omega$  4W  
 R8 0.1  $\Omega$  4W  
 R9 See below  
 R10 4.7 k $\Omega$  5W  
 R11 680 k $\Omega$  5%  
 R12 33 k $\Omega$  1%  
 R13 100 k $\Omega$  1%  
 R14 10 k $\Omega$  1%  
 R15 18 k $\Omega$  1%  
 R16 180  $\Omega$  1%  
 R17 120 k $\Omega$  2W  
 R18# 8.2 k $\Omega$  1% ( 110V see below )  
 R19 See below  
 R20 432 k $\Omega$  1% highvolt  
 R21 750 k $\Omega$  1%  
 R22 4.7  $\Omega$   
 R23 See below  
 R24 4.7  $\Omega$   
 R25 15 k $\Omega$  1%  
 R26 1 k $\Omega$  1%  
 R27 See below  
 R28 82  $\Omega$   
 R29 4.7 M $\Omega$   
 R30 See below  
 R31 220 k $\Omega$  1%  
 R32 See below  
 R33 See below  
 R34 See below  
 R35 See below  
 R36 15 k $\Omega$  1%  
 R37 See below  
 R38 See below  
 R39 See below  
 R40 See below  
 R41 18 k $\Omega$  1%  
 R42\* -  
 R43\* Jumper  
 R44 See below  
 R45 See below  
 R46 See below  
 R47 See below  
 R48 See Below

#### Capacitors

C1a# See below  
 C2a# See below  
 C5 0.68  $\mu$ F 250V  
 C6 -  
 C7 10  $\mu$ F 63V  
 C8 -  
 C9 10  $\mu$ F 50V  
 C10 22  $\mu$ F 50V  
 C11\* 470 pF NPO  
 C12 1 nF  
 C13 -  
 C14 10 nF  
 C15 See below  
 C16 330 pF  
 C17 -  
 C18 1 nF  
 C19 10  $\mu$ F 50V  
 C20 -  
 C21# 1.5 nF Y  
 C22# 1.5 nF Y  
 C23 1 nF  
 C24 See below  
 C25 See below  
 C26 1 nF  
 C27 See Below

#### Diodes

D1 BYT 12PI 1000  
 D2 See below  
 D3 15V 1.3W Zener  
 D4 5.6V 0.4W Zener  
 D5 1N 4148  
 D6 BYW 26C  
 D7 1N 4004  
 D8 1N 4148  
 D9 1N 4148  
 D10 1N 4148  
 D11 BYW 26C  
 D12 BZW 06P15B  
 D13 BAT 85  
 D14 1N 4148  
 D15 See below  
 D16 See below  
 D17 See below

#### Trim potentiometers

TP1 10 k $\Omega$   
 TP2 25 k $\Omega$   
 TP3 10 k $\Omega$   
 TP4\* 15 k $\Omega$  Resistor

#### Integrated circuits

U1 UC 3851 alt. UC 3841  
 U2 See below

#### Transistors

Q1 See below  
 Q2 See below  
 Q3 See below  
 Q4 BC 327  
 Q5 TIP 50  
 Q6 BC 547  
 Q7\* Jumper b-e  
 Q8 BC 557  
 Q9 See below  
 Q10 See below

#### Switches

S2 Temp switch 95°

#### Inductors

L1 See below

#### Jumpers

B1 See below  
 B2 See below

#### # 110V

C1b See below  
 C2b See below  
 C21 2,2nF Y  
 C22 2,2nF Y  
 R18 10k $\Omega$  1%

#### \* UC3841

R42 4.7 k $\Omega$   
 R43 82  $\Omega$   
 TP4 10 k $\Omega$   
 C11 1 nF  
 Q7 BC 337



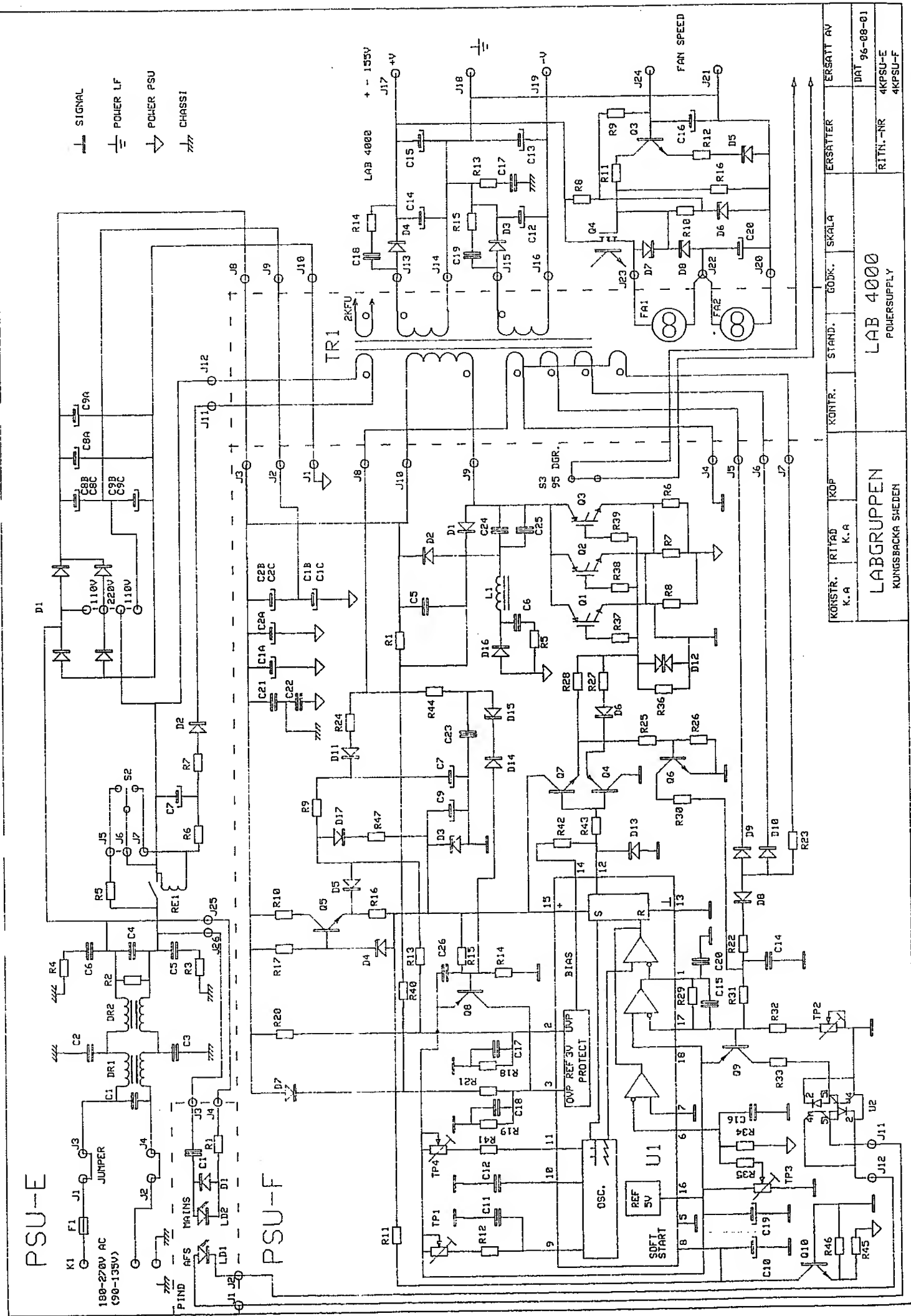
## POWER SUPPLY, BOARD PSUH

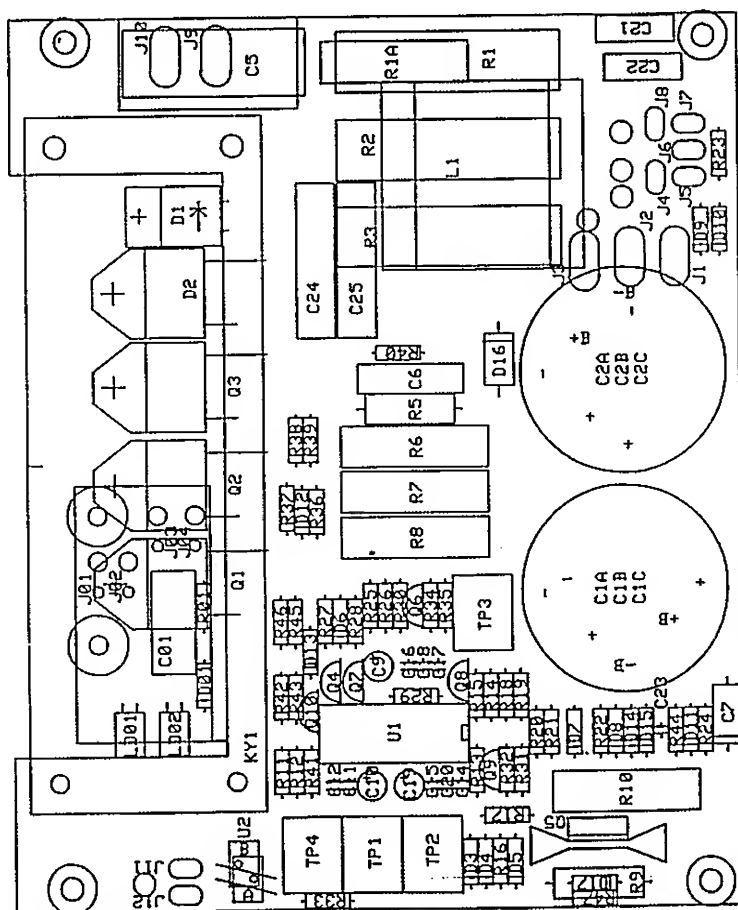
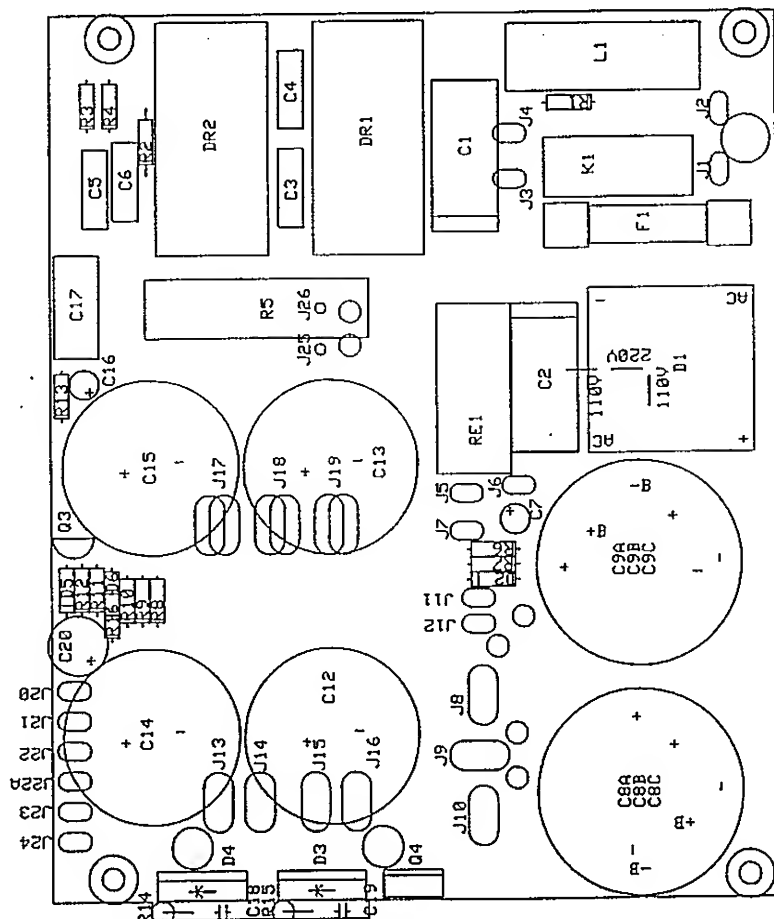
	LAB 1200C	LAB 1300C	LAB 1600	LAB 2000C	LAB 4000	PSU 48-8
R1	18 k $\Omega$ 9W	18 k $\Omega$ 9W	18 k $\Omega$ 9W	18 k $\Omega$ 9W	33 k $\Omega$ 9W	18 k $\Omega$ 9W
R2	18 k $\Omega$ 9W	18 k $\Omega$ 9W	18 k $\Omega$ 9W	18 k $\Omega$ 9W	-	18 k $\Omega$ 9W
R3	18 k $\Omega$ 9W	18 k $\Omega$ 9W	18 k $\Omega$ 9W	18 k $\Omega$ 9W	-	18 k $\Omega$ 9W
R5	-	-	-	-	330 $\Omega$ 2W	-
R9	1.5 k $\Omega$ 2W	1.5 k $\Omega$ 2W	1.5 k $\Omega$ 2W	1.5 k $\Omega$ 2W	1 k $\Omega$ 3W	1.5 k $\Omega$ 2W
R19	5.62 k $\Omega$ 1%	5.62 k $\Omega$ 1%	5.62 k $\Omega$ 1%	5.62 k $\Omega$ 1%	5.9 k $\Omega$ 1%	5.62 k $\Omega$ 1%
R23	8,2 k $\Omega$ 1%	6.8 k $\Omega$ 1%	6.8 k $\Omega$ 1%	6.8 k $\Omega$ 1%	6.8 k $\Omega$ 1%	10 k $\Omega$ 1%
R27	4.7 $\Omega$	4.7 $\Omega$	4.7 $\Omega$	4.7 $\Omega$	jumper	4.7 $\Omega$
R30	56 k $\Omega$ 1%	56 k $\Omega$ 1%	56 k $\Omega$ 1%	56 k $\Omega$ 1%	180 k $\Omega$ 1%	56 k $\Omega$ 1%
R32	133 k $\Omega$ 1%	88.7 k $\Omega$ 1%	169 k $\Omega$ 1%	88.7 k $\Omega$ 1%	88.7 k $\Omega$ 1%	-
R33	270 k $\Omega$ 1%	-	330 k $\Omega$ 1%	-	1 k $\Omega$ 1%	-
R34	2,2 k $\Omega$ 1%	2,0 k $\Omega$ 1%	2,2 k $\Omega$ 1%	2,2 k $\Omega$ 1%	2,4 k $\Omega$ 1%	-
R35	4.7 k $\Omega$ 1%	4.7 k $\Omega$ 1%	4.7 k $\Omega$ 1%	4.7 k $\Omega$ 1%	3,3 k $\Omega$ 1%	4.7 k $\Omega$ 1%
R37	4.7 $\Omega$	4.7 $\Omega$	4.7 $\Omega$	4.7 $\Omega$	2.2 $\Omega$	-
R38	4.7 $\Omega$	4.7 $\Omega$	4.7 $\Omega$	4.7 $\Omega$	2.2 $\Omega$	4.7 $\Omega$
R39	4.7 $\Omega$	4.7 $\Omega$	4.7 $\Omega$	4.7 $\Omega$	2.2 $\Omega$	4.7 $\Omega$
R40	1 M $\Omega$ 1%	1 M $\Omega$ 1%	1 M $\Omega$ 1%	1 M $\Omega$ 1%	1,2 M $\Omega$ 1%	1 M $\Omega$ 1%
R44	470 $\Omega$	470 $\Omega$	470 $\Omega$	470 $\Omega$	560 $\Omega$	470 $\Omega$
R45	-	-	-	-	698 $\Omega$ 1%	-
R46	-	-	-	-	196 $\Omega$ 1%	-
R47	-	-	-	-	820 $\Omega$	-
R48	2,2 $\Omega$ 2W	2,2 $\Omega$ 2W	2,2 $\Omega$ 2W	2,2 $\Omega$ 2W	-	2,2 $\Omega$ 2W
C1a#	220 uF 385V	220 uF 385V	220 uF 385V	220 uF 385V	-	220 uF 385V
C2a#	220 uF 385V	220 uF 385V	220 uF 385V	220 uF 385V	-	220 uF 385V
C1b#	-	-	-	-	1500 uF 200V	-
C2b#	-	-	-	-	1500 uF 200V	-
C6	-	-	-	-	1 nF 1.5 kV	-
C15	330 pF	330 pF	330 pF	330 pF	330 pF	1 nF
C24	-	-	-	-	22 nF 1kV	-
C25	-	-	-	-	22 nF 1kV	-
C27	100pF/1600V	100pF/1600V	100pF/1600V	100pF/1600V	-	100pF/1600V
D2	-	-	-	-	STTA 1512PI	-
D15	43V 2% Zener	43V 2% Zener	39V 2% Zener	43V 2% Zener	43V 2% Zener	30V 2% Zener
D16	-	-	-	-	BYM 26E	-
D17	-	-	-	-	1N4148	-
Q1	BUP 307	BUP 307	BUP 307	BUP 307	BUP 314S	BUP 307
Q2	BUP 307	BUP 307	BUP 307	BUP 307	BUP 314S	-
Q3	BUP 307	BUP 307	BUP 307	BUP 307	BUP 314S	-
Q9	Jumper b-c	-	Jumper b-c	-	BC557	-
Q10	-	-	-	-	BC547	-
U2	PC 113	-	PC 113	-	Jumper 1-5	PC 113
U2	-	-	-	-	Jumper 2-4	-
L1	-	-	-	-	400 uH LAB	-
B1	-	-	-	-	-	jumper
B2	-	-	-	-	-	jumper
<b># 110V</b>						
C1b#	1500 uF 200V	1500 uF 200V	1500 uF 200V	1500 uF 200V	-	1500 uF 200V
C2b#	1500 uF 200V	1500 uF 200V	1500 uF 200V	1500 uF 200V	-	1500 uF 200V
C1d#	-	-	-	-	2200 uF 200V	-
C2d#	-	-	-	-	2200 uF 200V	-
R18	10 k $\Omega$ 1%	10 k $\Omega$ 1%	10 k $\Omega$ 1%	10 k $\Omega$ 1%	-	-
<b>AFS IND.</b>						
R01	-	-	-	-	4,7 k $\Omega$ 1%	-
C01	-	-	-	-	0,1uF 400V	-
D01	-	-	-	-	1N4148	-
LD01	-	-	-	-	green 2,5x5mm	red 2,5x5mm
LD02	-	-	-	-	red 2,5x5mm	green 2,5x5mm

# **Old versions Lab 4000**

## **OLD VERSIONS**

<b><u>PAGE</u></b>	<b><u>CONTENTS</u></b>	<b><u>DRAWING SCHEMATIC</u></b>	<b><u>LAYOUT</u></b>
22-25	POWER SUPPLY <small>FROM SERIAL NO. 960-901 TO 981-225</small>	2KPSU-E 2KPSU-F	2KPSUE-P 2KPSUF-P





KONSTR.	RITAD	KOP	KONTR.	STAND.	GÖDK.	SKALA	ERSÄTT	ERSÄTT AV
K.A.	K.A.							
LABGRUPPEN							RITN.-NR	DAT 96 00 20
KUNGSBACKA SWEDEN							4KPSUE-P	4KPSUF-P
LAB 4000							POWERSUPPLY	

# LAB 4000

## POWER SUPPLY, BOARD PSUE AND AFS IND. BOARD

### component-list

#### PSU E

##### Resistors

R1-  
R2 1 M $\Omega$  1%  
R3 33  $\Omega$   
R4 33  $\Omega$   
R5# 47  $\Omega$  9W  
R6 33  $\Omega$   
R7 2.2  $\Omega$  1W  
R8 27 k $\Omega$  1% on legs  
R9 180 k $\Omega$  1%  
R10 39 k $\Omega$  1%  
R11 18 k $\Omega$  1%  
R12 4,7 k $\Omega$  1%  
R13 4.7  $\Omega$   
R14 -  
R15 -  
R16 -

##### Capacitors

C1 0.47  $\mu$ F  
C2# 1.5 nF Y  
C3# 1.5 nF Y  
C4 0.22  $\mu$ F  
C5# 1.5 nF Y  
C6# 1.5 nF Y  
C7 100  $\mu$ F 50V  
C8b# 1500  $\mu$ F 200V  
C9b# 1500  $\mu$ F 200V  
C12 1800  $\mu$ F 160V  
C13 1800  $\mu$ F 160V  
C14 1800  $\mu$ F 160V  
C15 1800  $\mu$ F 160V  
C16 22  $\mu$ F 16V  
C17 2.2  $\mu$ F 63V  
C18 -  
C19 -  
C20 100  $\mu$ F 50V

##### Diodes

D1 600V 35A  
D2 BYW26C  
D3 BYT30PI600  
D4 BYT30PI600  
D5 5.6V Zener  
D6 62 V  $\pm$ 2% Zener  
D7\* 15v Zener  
D8\* 39V  $\pm$ 2% Zener

##### Fuses

F1# T15AH250V

##### Transistors

Q3 BC 546  
Q4\* IRF730

##### Coils

DR1# 2.7mH 16  
DR2# 2.7mH 16

##### Switches

S1 Jumpers  
S2 Marquart 1803.0102  
S3 Comepa 4JT95 ARIUI 95°C

##### Relays

RE1 FEME MZF 0014816

##### # 110V AC

R5 22  $\Omega$  9W?  
C2 2,2 nF Y  
C3 2,2 nF Y  
C5 2,2 nF Y  
C6 2,2 nF Y  
C8b 2200  $\mu$ F 200V  
C9b 2200  $\mu$ F 200V  
F1 T30A  
DR1 2,6mH 30A  
DR2 2,6mH 30A

#### AFS IND.

RA 4,7 k $\Omega$  1%  
CA# 0,1uF 400V  
DA Led G  
DB Led Y

##### # 110V AC

CA 0,22uF 250V

\* UNTIL 9708

Q4 BDX53f  
D7 -  
D8 -

# LAB 4000

## POWER SUPPLY, BOARD PSUF

### component-list

UC 3851

**Resistors**

R1 33 k $\Omega$  9W  
 R2 -  
 R3 -  
 R4 -  
 R5 330  $\Omega$  2W  
 R6 0.1  $\Omega$  4W  
 R7 0.1  $\Omega$  4W  
 R8 0.1  $\Omega$  4W  
 R9 1 k $\Omega$  3W  
 R10 4.7 k $\Omega$  7W  
 R11 680 k $\Omega$  5%  
 R12 33 k $\Omega$  1%  
 R13 100 k $\Omega$  1%  
 R14 10 k $\Omega$  1%  
 R15 18 k $\Omega$  1%  
 R16 180  $\Omega$  1%  
 R17 120 k $\Omega$  2W  
 R18 8.2 k $\Omega$  1%  
 R19 5.9 k $\Omega$  1%  
 R20 432 k $\Omega$  1% highvolt  
 R21 750 k $\Omega$  1%  
 R22 4.7  $\Omega$   
 R23 6.8 k $\Omega$  1%  
 R24 4.7  $\Omega$   
 R25 15 k $\Omega$   
 R26 1 k $\Omega$   
 R27 Jumper  
 R28 82  $\Omega$  5%  
 R29 4.7 M $\Omega$   
 R30 270 k $\Omega$  1%  
 R31 220 k $\Omega$  1%  
 R32 88.7 k $\Omega$  1%  
 R33 1 k $\Omega$   
 R34 2.2 k $\Omega$  1%  
 R35 ~~4.7 k $\Omega$  1%~~ 3.3 k $\Omega$  1%  
 R36 15 k $\Omega$  1%  
 R37 2.2  $\Omega$   
 R38 2.2  $\Omega$   
 R39 2.2  $\Omega$   
 R40 1.2 M $\Omega$  1%  
 R41 18 k $\Omega$  1%  
 R42\* -  
 R43\* Jumper  
 R44 560  $\Omega$   
 R45 1.4 k $\Omega$  1%  
 R46 390  $\Omega$  1%  
 R47 820  $\Omega$

**Capacitors**

C1b# 1500  $\mu$ F 200V  
 C2b# 1500  $\mu$ F 200V  
 C5 0.6  $\mu$ F 500V  
 C6 1 nF 1.5 kV  
 C7 10  $\mu$ F 63V  
 C8 -  
 C9 10  $\mu$ F 50V  
 C10 22  $\mu$ F 50V  
 C11\* 470 pF NPO  
 C12 1 nF  
 C13 -  
 C14 10 nF  
 C15 330 pF  
 C16 330 pF  
 C17 -  
 C18 1 nF  
 C19 10  $\mu$ F 50V  
 C20 -  
 C21# 1.5 nF Y  
 C22# 1.5 nF Y  
 C23 1 nF  
 C24 22 nF 1kV  
 C25 22 nF 1kV  
 C26 1 nF (on solderside)  
 (from 97-08)

**Diodes**

D1 BYT 12PI 1000  
 D2 STTB 1512PI  
 D3 15V 1.3W Zener  
 D4 5.6V 0.4W Zener  
 D5 1N 4148  
 D6 BYW 26C  
 D7 1N 4004  
 D8 1N 4148  
 D9 1N 4148  
 D10 1N 4148  
 D11 BYW 26C  
 D12 BZW 06P15B  
 D13 BAT 85  
 D14 1N 4148  
 D15 43V 2% Zener  
 D16 BYM 26D  
 D17 1N4148

**Trim potentiometers**

TP1 10 k $\Omega$   
 TP2 25 k $\Omega$   
 TP3 10 k $\Omega$   
 TP4\* 15 k $\Omega$  Resistor 1%

**Integrated circuits**

U1 UC 3851 alt. UC 3841  
 U2 PC 113

**Transistors**

Q1 BUP 314S  
 Q2 BUP 314S  
 Q3 BUP 314S  
 Q4 BC 327  
 Q5 TIP 50  
 Q6 BC 547  
 Q7\* Jumper b-e  
 Q8 BC 557  
 Q9 BC557  
 Q10 BC547

**Inductors**

L1 400uH LAB

**Switches**

S2 Temp switch 95°

**# 110V**

C1b 2200  $\mu$ F 200V  
 C2b 2200  $\mu$ F 200V  
 C21 2.2nF Y  
 C22 2.2nF Y

**\* UC3841**

R42 4.7 k $\Omega$   
 R43 82  $\Omega$   
 TP4 10 k $\Omega$   
 C11 1 nF  
 Q7 BC 337